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VOLUME 13, NUMBER 9
MAY 1, 1980

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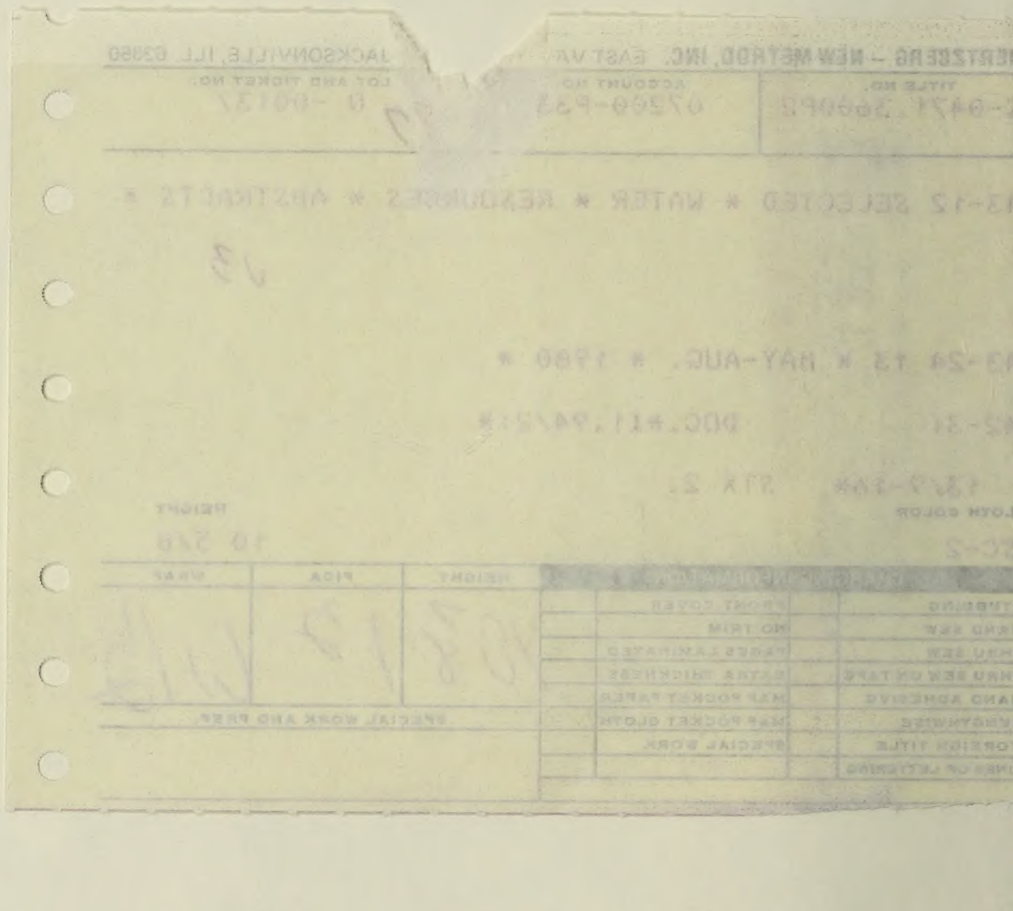

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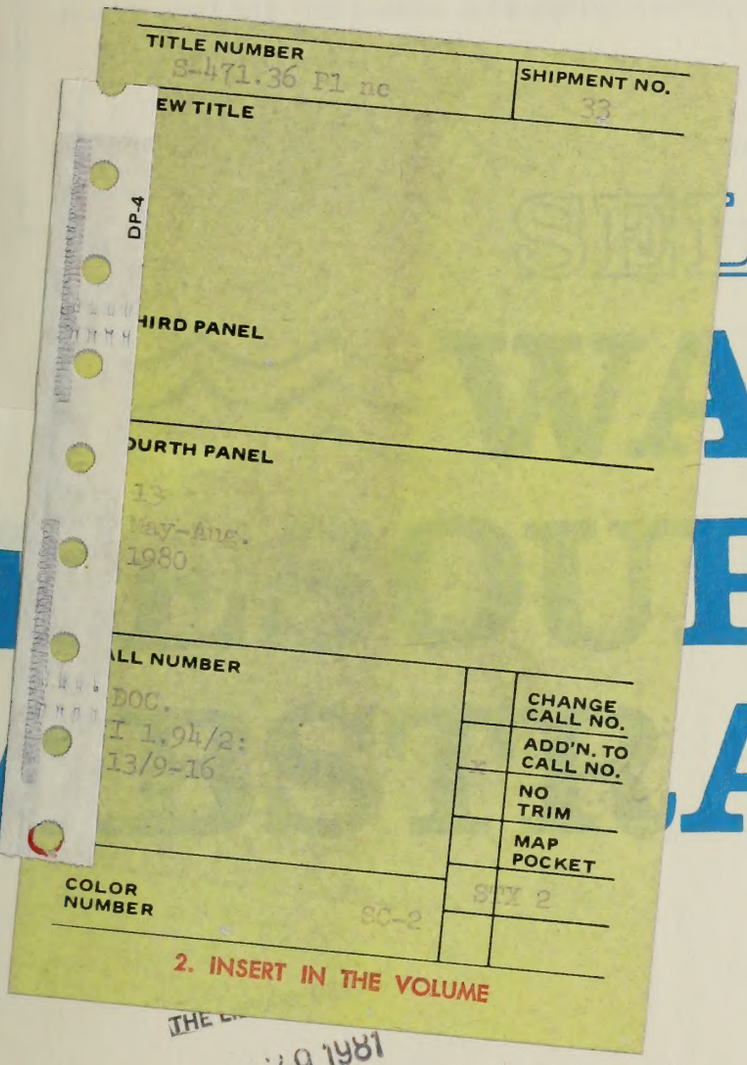

SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 9
MAY 1, 1980

W80-03001 – W80-03300

he Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in
e transaction of the public business required by law of this Department. Use of funds for printing this periodical has been
pproved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

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08 ENGINEERING WORKS

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09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

THE SIMULATION OF TRANSMISSIVITY, STORATIVITY AND EVAPOTRANSPIRATION IN A DIGITAL MODEL OF A FISSURED DOLOMITE AQUIFER NEAR NDOLA, ZAMBIA,
Institute of Geological Sciences, Wallingford (England).
For primary bibliographic entry see Field 2F.
W80-03033

EFFECTS OF PARAMETER UNCERTAINTY IN A FLOW ROUTING MODEL,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W80-03035

KUTSE GAME RESERVE: FIELD TRIP TO A DROUGHT-PRONE ENVIRONMENT,
Botswana Ministry of Local Government and Lands, Gaborone.
H. I. D. Vierich, and R. K. Hitchcock.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 21-30, 1979. 4 Fig, 9 Ref.

Descriptors: *Droughts, *Climatology, *Migration patterns, *Botswana, *Wildlife habitats, Paleohydrology, Ecosystems, Environmental effects, Vegetation establishment, History, Kalahari Desert, Kutse Game Reserve, Africa.

The Kutse Game Reserve, covering 2,440 sq. km. in the south-central Kalahari Desert, has been subjected to both long- and short-term climatic alteration. Drought-induced changes occurring in the recent past have formed the Reserve into a good example of a drought-prone environment for several reasons: (1) it is inhabited by migratory wildlife, some of which are well adapted to aridity, (2) vegetation adapted to extremely dry conditions, (3) human populations subsisting by adapting, (4) animals owned by Kutse residents are usually small stock, especially goats adapted to arid conditions, (5) water-stress induced migratory patterns of both hunter-gatherer and pastoral-agricultural Kutse residents can be traced, and (6) Kutse's climatic history is etched in the landscape by fossil river valleys as well as by the vegetational history revealed by huge tree stumps which have been cut or burned. Kutse is an ideal exposition to the investigator of a semiarid ecosystem with a history of climatic, vegetational, and historical change over thousands of years. (Tickes-Arizona)
W80-03059

A MINI-GUIDE TO THE WATER RESOURCES OF BOTSWANA,
Department of Water Affairs, Gaborone (Botswana).
B. H. Wilson.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 59-68, 1979. 32 Fig, 21 Ref.

Descriptors: *Water resources, *Mapping, *Botswana, *Groundwater, *Runoff, Droughts, Soils, Aquifers, Boreholes, Springs, Dams, Rivers.

A series of annotated maps and diagrams of the water resources of Botswana, intended to be suggestive rather than conclusive, are presented, including annual rainfall, rainfall disposition, annual rainfall probability, evapotranspiration and rain, rivers, dams, boreholes, hand-dug wells, hafirs, springs, aquifers, water weeds, groundwater recharge, pollution, soils, and droughts. (Tickes-Arizona)
W80-03063

DESERTIFICATION: NATURAL OR MAN-INDUCED,
Cambridge Univ. (England). Dept. of Geography.
A. T. Grove.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 71-74, 1979.

Descriptors: *Desertification, *Droughts, *Environmental effects, *Biodegradation, Natural resources, Land resources, Conservation, Arid lands, Semiarid climates.

Although the process of desertification has operated in the past, this century is peculiar in the severity of the risks and the extent of regions threatened by this process. The seriousness of the situation varies from country to country within the arid zone, one which occupies about one-third of the earth's land surface, and is greatest in the poorer semiarid lands lacking industries and without oil. It is suggested here that the imbalance among nations underlies and compounds the problems both of drought hazards and of the longer term degradation of semiarid lands. It is concluded that the present order is basically unstable, and liable to be disrupted within a period of much less than a lifetime. Under such circumstances, it is essential over the long term to conserve the natural biological resources of the semiarid lands. (Tickes-Arizona)
W80-03064

THE TRADITIONAL RESPONSE TO DROUGHT IN BOTSWANA,
Botswana Ministry of Local Government and Lands, Gaborone.
R. K. Hitchcock.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 91-97, 1979. 19 Ref.

Descriptors: *Droughts, *History, *Social mobility, *Social values, Climatology, Botswana, Regional analysis.

Ethnohistorical and oral history information is the basis for this description of traditional responses in Botswana to drought, a common, almost characteristic phenomenon in this largely arid country. The many varied responses elucidated here range from mobility to reversion to hunting and gathering and magico-religious ceremonies for inducing rainfall. Although socioeconomic strategies may have been somewhat more effective in coping with drought than their ideological counterparts, it is argued here that strategies such as rain making ceremonies provided people with a sense of security often strongly needed during periods of drought, and represent important mechanisms for alleviating social stress in an unpredictable environment. Traditional drought responses in Botswana, it is further emphasized, cannot be viewed as separate from the political economy of southern Africa. (Tickes-Arizona)
W80-03067

TECHNIQUES FOR REAL-TIME OPERATION OF FLOOD CONTROL RESERVOIRS IN THE MERRIMACK RIVER BASIN,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6B.
W80-03198

A MODEL FOR EVALUATING RUNOFF-QUALITY IN METROPOLITAN MASTER PLANNING,
Water Resources Engineers Inc., Walnut Creek, CA.
For primary bibliographic entry see Field 5B.
W80-03199

ADJUSTMENT OF PEAK DISCHARGE RATES FOR URBANIZATION,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
D. L. Gundlach.
Technical Paper No 54, February 1979. 5 p, 3 Fig, 8 Ref, 1 Append.

Descriptors: *Urbanization, *Peak discharge, *Hydrograph analysis, *Urban hydrology, Model studies, Watersheds(Basins), Floods, Surface runoff, Runoff, Storm runoff, Hydrologic aspects, Analytical techniques.

Various investigators have shown that changes from rural to urban conditions within a watershed, in general, significantly affect flood flows. Recorded annual peak discharge rates (or peak discharge rates above a given base) for a basin that has been undergoing a change in land-use conditions represent a nonstationary time series. The series must be adjusted to a specific land-use condition (typically present conditions) prior to performing a statistical frequency analysis. It was the aim of this note to present a procedure utilizing a single event rainfall-runoff model for transforming recorded peak discharges at a gaging station to a consistent set that reflects existing land-use conditions. Methods presented can be used as a guide to determine an existing-condition discharge frequency curve of annual peaks (or peak discharge rates above a given base) when utilizing a single event rainfall-runoff model. The multiplan-ratio option of HEC-1 permits the user to calculate systematically the hydrologic response of several storm events for a given set of land-use conditions. The adjustment procedure described is also applicable when predicting runoff for estimated future conditions. (See also W69-06445, W71-06690, W73-05381, and W75-02119) (Humphreys-ISWS)
W80-03200

DIRECT RUNOFF HYDROGRAPH PARAMETERS VERSUS URBANIZATION,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
D. L. Gundlach.
Technical Paper No 48, September 1976. 5 p, 2 Fig, 2 Tab, 6 Ref, 1 Append.

Descriptors: *Urbanization, *Urban hydrology, *Hydrograph analysis, *Model studies, Storm runoff, Hydrographs, Unit hydrographs, Floods, Watersheds(Basins), Surface runoff, Analytical techniques, Analysis, Impervious surfaces.

Various rainfall-runoff models are based on the development of unit hydrographs, loss rate functions, and routing criteria. With models of this type, characteristics used to define the unit hydrograph, loss rate, and routing criteria need to be modified to predict runoff that would occur because of future development within a watershed. Certain aspects of this problem, particularly changes in peak flow and lag time due to urbanization, have been treated previously. It was the aim of this note to present additional information regarding the modification of unit hydrograph characteristics due to increased urbanization and to introduce techniques which can be utilized in a practical solution. Relationships presented in this paper can be used as a guide to compute the regional unit hydrograph parameters: TC(the time in hours from the end of effective rainfall to the inflection point on the recession limb of the hydrograph) and R (the ratio in hours of the discharge at the inflection point on the recession limb of the hydrograph to the rate of change of discharge at that point), for existing and predicted values of imperviousness. Modified expressions, such as those developed, are applicable for all values of I (the percentage of impervious surface within a watershed) and the ratio of existing to future impervious surface. (See also W75-01124, W75-02119, and W75-10709) (Humphreys-ISWS)
W80-03205

THE EVALUATION OF A HYDRODYNAMIC WATERSHED MODEL (IHW MODEL IV), A CONTRIBUTION TO THE INTERNATIONAL HYDROLOGICAL DECADE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
C. H. Hsie, V. T. Chow, and B. C. Yen.
Hydraulic Engineering Series No 28, UILU-ENG-74-2013, August 1974. 154 p, 23 Fig, 3 Tab, 73 Ref, 3 Append, NSF GK-11292, GK-40867.

Descriptors: *Watersheds(Basins), *Model studies, *Hydrograph analysis, *Runoff, *Hydrology,

Field 2—WATER CYCLE

Group 2A—General

Mathematical models, Mathematical studies, Laboratory tests, Hydraulic models, Computer models, Computer programs, Discharge(Water), Hydrologic cycle, Analytical techniques, Routing, Hydraulics, Streamflow, Surface runoff, Overland flow, Flood routing, Kinematic wave model, Dynamic wave model.

This report described the mechanics of surface runoff on a laboratory watershed as simulated by two mathematical models: the dynamic wave model and the kinematic wave model. Each of these two simulation models consists of a pair of one-dimensional spatially varied unsteady flow equations that are derived from the principles of conservation of mass and momentum. In the dynamic wave model, the St. Venant form of both the continuity and momentum equations is used; whereas in the kinematic wave model, only the continuity equation is retained in its differential form and an approximation to the momentum equation is employed. Numerical solution of these quasi-linear partial differential equations describing the flow was attained on computer by adopting an explicit characteristic method. Laboratory flow data were used to verify the validity of the analytical models and to evaluate their applicabilities. For the cases tested, fairly good agreement was found between the computed and measured results with the dynamic wave model being consistently more satisfactory and also less sensitive to the friction factor than the kinematic wave model. The relationships between peak discharges and rainfall intensity, rainfall duration, watershed surface slope, and surface roughness were also investigated by using the dynamic wave model. (Humphreys-ISWS)
W80-03206

2B. Precipitation

SECONDARY PERMEABILITY AS A POSSIBLE FACTOR IN THE ORIGIN OF DEBRIS AVALANCHES ASSOCIATED WITH HEAVY RAINFALL,
Everett and Associates, Rockville, MD.
A. G. Everett.
Journal of Hydrology, Vol 43, No 1/4, p 347-354, October 1979. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Excessive precipitation, *Rainfall, *Floods, *Landslides, *Debris avalanches, *West Virginia, Precipitation(Atmospheric), Soil water, Permeability, Soil water movement, Erosion, Drainage, Streams, Rivers, Runoff, Mountains, Slopes, Avalanches, Soils, Storm runoff, Secondary permeability.

Throughout much of the Appalachian region, heavy rainfall leads not only to flooding but also to extensive erosion and landsliding. Such a heavy rainfall occurred on August 18, 1972, in southwestern West Virginia with the heaviest rainfall and resultant damage centered over the Gilbert and Bens Creek drainages. Landslides, in the form of debris avalanches, were the principal form of mass movement during the storm. A number of these landslides appear to have resulted from soil zone saturation associated with temporary spring flows issuing from bedrock to the soil mantle where joints in highly fractured shales and coal beds intersected underlying, relatively unjointed, sandstones. Thus, it appears that, in this case, increased pore-water pressures as an effect of concentration of flow through secondary permeability played a substantial role in the localization and formation of slide masses. How widespread this phenomenon may be is not known. (Sims-ISWS)
W80-03048

CORRELATION ANALYSIS OF THE JORDAN VALLEY RAINFALL FIELD,
Hebrew Univ. (Jerusalem). Inst. of Earth Sciences.
D. Sharon.
Monthly Weather Review, Vol 107, No 8, p 1042-1047, August 1979. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Rainfall disposition, *Depth-area-duration analysis, *Weather patterns, Precipitation(Atmospheric), Distribution patterns, Hydrometeorology, Topography, Jordan Valley, Israel.

A correlation analysis of the Jordan Valley Rainfall Field is presented, based upon spatial correlation function of daily rainfall both within the Valley itself and in relation to the surrounding rainfall field over the central hilly part of Israel and its downward extension deep into northern Jordan. Results derived from data for seven winter seasons between 1960 and 1967 from 92 stations indicate that rainfall patterns causing this region to be an arid enclave within an area receiving up to 700mm of rain annually are independent in terms of timing of rainfall events and their characteristics such as spatial extent, intensity, and duration. This independence, relative to the surrounding uplands, is explained not only in terms of an inverse orographic effect, but also by an increase in local convective activity that may be ascribed to the thermal and dynamic effects of the abrupt valley topography. (Tickes-Arizona)
W80-03056

SOUTHERN AFRICAN RAINFALL: PAST, PRESENT AND FUTURE,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography and Environmental Studies.
P. D. Tyson.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 45-52, 1979. 6 Fig, 7 Ref.

Descriptors: *Weather forecasting, *Rainfall, *Synoptic analysis, Climatology, Depth-area curves, Distribution patterns, Africa.

Except for a restricted area along the south coast, precipitation over Southern Africa is highly seasonal in character and strongly influenced by the position of the subcontinent in relation to the pressure and wind systems of the southern hemisphere. Atmospheric circulation and rainfall patterns are well documented, although how the frequency of occurrence of various synoptic types has varied historically is not known. While no radical one-sided trends can be isolated in South African rainfall, quasi-periodic fluctuations appear to have persisted throughout the period of meteorological record and South Africa as a whole appears not to have undergone a uniform pattern of climatic change. Instead, areas of the country with different seasonal rainfall regions have behaved differently in response to different meteorological mechanisms, producing the rainfall associated with each regime. In the absence of any deterministic models to predict future climatic changes, the likelihood is great that the summer rainfall region of southern Africa, including Botswana, will experience a series of below-normal rainfall years in the 1980s with subsequent periods of extended drought. (Tickes-Arizona)
W80-03061

SOME SOCIOLOGICAL ASPECTS OF DROUGHT,
University Coll. of Botswana, Gaborone. Dept. of Sociology.
K. K. Prah.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society, in collaboration with Clark University Press. p 87-90, 1979. 14 Ref.

Descriptors: *Droughts, *Social adjustment, *Social change, Psychological aspects, History.

Drought inevitably brings a host of sociological problems for which societies have devised a variety of ameliorative measures, depending on their level of development. This brief historical review indicates that while some societies have attacked the problem of drought and aridity more radically than others, it can be concluded that differing historical epochs generally have created sociocultural features enabling men to check and mitigate the effects of aridity and low rainfall. It is suggested that contemporary social problems often arise because of an imbalance developing between these societies and the environments in which they have traditionally existed. (Tickes-Arizona)
W80-03066

2C. Snow, Ice, and Frost

CHARACTERISTICS OF SUBARCTIC SNOWCOVER,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
J. E. Fitzgibbon, and T. Dunne.
Hydrological Sciences Bulletin, Vol 24, No 4, p 465-476, December 1979. 4 Fig, 5 Tab, 11 Ref.

Descriptors: *Snowpacks, *Canada, *Watersheds(Basins), *Vegetation effects, Snowmelt, On-site investigations, Analytical techniques, Water equivalent, Areal, Properties, Data collections, Snow surveys, Vegetation, Variability, Snow cover, Snow management, Forest management, Burning, Subarctic, Distribution patterns, *Schefferville(Quebec), Snowpack properties.

The areal and temporal characteristics of the snowpack in a small subarctic drainage basin at Schefferville, Quebec, were analyzed prior to and during the snowmelt in 1972 and 1973. The data showed that vegetation cover is of prime importance in determing the areal distribution of snowpack properties. The areal distribution of snow water equivalent could be characterized by a normal distribution in each of four vegetation cover types. It was found that the mean and standard deviation of snow water equivalent are closely related to vegetation cover. Also, mean snow water equivalent varies from year to year, but standard deviation shows no significant variation. This suggests that mean accumulation is the result of annual snowfall amounts, while the variability is due to the effects of vegetation cover and accumulation processes. The data also showed that during the snowmelt, the variability of snowcover properties shows no significant change. Using the normal distributions of the peak accumulation snow water equivalents, and observed and calculated melt rates, the areal extent of snowcover was determined. (Humphreys-ISWS)
W80-03034

WINTER ICE JAMS ON THE GUNNISON RIVER,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
P. H. Burgi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-131543, Price codes: A03 in paper copy, A01 in microfiche. Report No REC-ERC-79-4, February 1979. 35 p, 26 Fig, 4 Tab, 9 Ref.

Descriptors: *Ice jams, *Colorado River, *Winter, *River flow, Frazil ice, Ice cover, Freezing, Ice loads, Ice breakup, Reservoirs, Water temperature, Climatic data, Weather, Gunnison River, Floods.

The formation, transport, and accumulation of ice on a 14 km stretch of the Gunnison River in Colorado was studied during a six year period. The Gunnison River, a principal tributary of the Colorado River, has an average elevation of 2,300 m above sea level for the area studied. Located along the study area are two reservoirs, the Taylor Park Reservoir which is upriver from the Blue Mesa Reservoir at the lower end of the area. Winter conditions are severe with 3 days in January of 1971 having a maximum temperature of -18 C or below with the lowest temperature being -38 C. Various river channelization, river snagging, and clearing operations have been performed in an attempt to reduce the ice jamming problem. Since 1967 with the filling of the Blue Mesa Reservoir descriptive records have been kept on the winter ice jams. Summaries of these annual descriptions are included. Study results show that the elevation of the Blue Mesa Reservoir at the end of November is a major factor in determining the location of the ice jam head at the start of the season. The higher the reservoir, the further upstream the ice jam starts. Clearing and snagging operations have had little effect on reducing the jamming, howev-

er, the construction of larger ice collection areas has helped. A good correlation was observed between upstream ice jam movement and average temperature below minus 10 C. Large releases from the Taylor Park Reservoir during the winter contribute to the ice formation problem. Data summaries, maps, and photographs are included. (Seigler-IPA)
W80-03100

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 4.
Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
September 1979. 110 p.

Descriptors: *Glaciology, *Snow, *Ice, *Bibliographies, Computers, Snow cover, Glaciers, Avalanches, Polar regions, Sea ice, Permafrost, Abstracts, Data collections, Publications, Paleoglaciology, Polar ice.

The quarterly list of documents acquired by the Data Center during the period April-June 1979 has been published. Books, technical reports, conference proceedings, and reprints were included; most journal articles have not been indexed. Entries are listed by author and subject. Due to space considerations, however, complete bibliographic information for a document is given only under the author entry. The subject headings are those used by the U.S. Army Cold Regions Research and Engineering Laboratory in their Bibliography on Cold Regions Sciences and Technology. (Preece-ISWS)
W80-03208

2D. Evaporation and Transpiration

A SENSITIVITY ANALYSIS OF THE PENMAN-MONTEITH ACTUAL EVAPOTRANSPIRATION ESTIMATES,
Institute of Hydrology, Wallingford (England).
K. Beven.
Journal of Hydrology, Vol 44, No 3/4, p 169-190, December 1979. 10 Fig, 22 Ref, 2 Append.

Descriptors: *Evapotranspiration, *Model studies, *Hydrology, Data collections, Input-output analysis, Humid climates, Temperate, Canopy, Watersheds(Basins), Equations, *Sensitivity analysis, *Penman-Monteith equation, Systeme hydrologique europeen, Error variance, Humid temperate region, Aerodynamic resistance, Canopy resistance.

A brief description was given of the evapotranspiration component, based on the Penman-Monteith equation, of the distributed Systeme Hydrologique Europeen model of catchment hydrology. The importance of evapotranspiration predictions to the operation of the model was stressed, together with expected error variance associated with estimates of evapotranspiration. The sensitivity of such estimates to errors in input data and estimated model parameter values can be investigated. It was shown that for dry canopy conditions at three sites within a broadly humid temperate region, the sensitivity of Penman-Monteith estimates of evapotranspiration to different input data and parameters is very dependent on the values of the aerodynamic and canopy resistance parameters that introduced the influence of vegetation type into the predictions. For forest surfaces, in particular, the evapotranspiration predictions were highly sensitive to values of the canopy resistance, so that accurate estimation of this parameter was important. (Roberts-ISWS)
W80-03036

2E. Streamflow and Runoff

EFFECTS OF PARAMETER UNCERTAINTY IN A FLOW ROUTING MODEL,
Institute of Hydrology, Wallingford (England).
P. Whitehead, G. Hornberger, and R. Black.
Hydrological Sciences Bulletin, Vol 24, No 4, p 445-464, December 1979. 12 Fig, 25 Ref.

Descriptors: *Routing, *Model studies, *Australia, Runoff, Hydrologic systems, Parametric hydrology, Monte Carlo method, Flow, Hydrology, Flow routing models.

A Monte Carlo simulation approach was used to investigate the effects of parameter uncertainty in a 'nonlinear storage' flow routing model on downstream flow prediction. The analysis was oriented towards a study of the problem of routing the measured discharge hydrograph at Hughes Bridge on the Murray River, Western Australia, to an ungauged point some 36 km downstream, but implications of the results pertain to broader issues of flow routing in inadequately gauged rivers. The downstream flow predictions were insensitive to N, the number of reaches into which the river segment is divided, and, for small perturbations in inflow, were also relatively insensitive to a and b, the travel time parameters. Peak flow predictions, however, depended strongly on the values of a and b, and consequently accurate flood prediction required careful determination of these parameters. The estimate of the 'gain' in discharge at a downstream station due to lateral inflow in the river segment is also subject to considerable uncertainty, and mis-estimates of this parameter can result in poor predictions of downstream flows. (Lee-ISWS)
W80-03035

SECONDARY PERMEABILITY AS A POSSIBLE FACTOR IN THE ORIGIN OF DEBRIS AVALANCHES ASSOCIATED WITH HEAVY RAINFALL,
Everett and Associates, Rockville, MD.
For primary bibliographic entry see Field 2B.
W80-03048

HYDROLOGIC DATA FOR FLOODS OF JULY 1978 IN SOUTHEAST MINNESOTA AND SOUTHWEST WISCONSIN,
Geological Survey, St. Paul, MN. Water Resources Div.
V. J. Latkovich.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Microfiche $3.50, printed copy $4.00. Geological Survey, open-file report 79-1166, 1979. 29 p, 18 Fig, 2 Tab.

Descriptors: *Hydrologic data, *Historic floods, *Minnesota, *Wisconsin, *Thunderstorms, Flood profiles, Flood damage, Documentation, Stage-discharge relations, Flood frequency, Sediments, Aerial photography, Current meters, Indirect flood measurement, Gaging stations, Peak discharge, Flood recurrence interval, *Southeast Minnesota, *Southwest Wisconsin.

Intense storms of July 1978 caused floods of historical significance in southeast Minnesota and southwest Wisconsin. Local, State, and Federal officials need data and information to evaluate, coordinate, and manage programs concerned with floods and flood losses. Because of a need to document stream discharges, elevations, and sediment concentrations, current-meter and indirect measurements were made at 34 gaging stations during or immediately after the floods. This report summarizes some of the hydrologic data collected. Peak discharges of record occurred at 20 gaging stations. Frequency of peak discharge equaled or exceeded the 100-year recurrence interval at 11 stations. The Federal Benchmark gaging station on the North Fork Whitewater River was destroyed. Five people died as a result of the floods, and property damages were estimated to exceed $114 million. Thirty-three counties were officially declared disaster areas. (Kosco-USGS)
W80-03158

FLOODS IN PUERTO RICO, MAGNITUDE AND FREQUENCY,
Geological Survey, Tampa, FL. Water Resources Div.; and Geological Survey, Fort Buchanan, PR. Water Resources Div.
M. A. Lopez, E. Colon-Dieppa, and E. D. Cobb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 855, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-141, June 1979. 66 p, 13 Fig, 3 Tab, 59 Ref.

Descriptors: *Floods, *Flood frequency, *Puerto Rico, *Regression analysis, *Regional analysis, Peak discharge, Streamflow, Gaging stations, Watersheds(Basins), Drainage area, Rainfall-runoff relationships, Frequency curves.

Annual-peak discharge records at 50 sites in Puerto Rico with five or more years of record were used to determine individual site log-Pearson type III frequency curves. The frequency curve values for 2-, 10-, 25-, 50-, and 100-year recurrence intervals at 37 sites with 10 or more years of record were regressed against basin characteristics. Drainage area and mean annual rainfall proved to be the only independent variables significant at the 95 percent confidence level in these regression equations. (Woodard-USGS)
W80-03161

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART II LOW-FLOW FREQUENCY CHARACTERISTICS OF THE SUSQUEHANNA RIVER BETWEEN WAVERLY, NEW YORK AND SUNBURY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-03163

UNSTEADY STREAMFLOW MODELING GUIDELINES,
Nevada Univ. System, Reno. Water Resources Center; and Nevada Univ. System, Reno. Dept. of Civil Engineering.
V. L. Gupta, S. M. Afaq, J. W. Fordham, and J. M. Federici.
Journal of Hydrology, Vol 43, No 1/4, p 79-97, October 1979. 14 Fig, 4 Tab, 16 Ref. OWRT A-057-NEV(4), B-096-NEV(1).

Descriptors: *Streamflow, *Floods, *Model studies, *Mathematical models, *Nevada, Rivers, Lakes, Flow, Historic floods, Hydrographs, Synthetic hydrology, Analytical techniques, Mathematics, Hydrology, *Truckee River(NV).

Presented was a case study of one-dimensional modeling of spatially varied unsteady flow regime in a river, utilizing the continuity and momentum formulations of Saint-Venant equations. The emphasis was on sensitivity analyses of the modeling framework for obtaining guidelines for modeling exercises. Finite-difference schemes were compared relative to their efficacy in simulating flow regimes. Model response was examined with respect to changes in six parameters, namely: (1) grid size; (2) lateral inflow or outflow rates; (3) discrete and composite description of hydraulic elements; (4) discrete and composite description of bed slopes; (5) roughness coefficient of stream bed; and (6) magnitude of weighting parameter. (Sims-ISWS)
W80-03167

HYDRAULIC GEOMETRY AND CARRYING CAPACITY OF FLOODPLAINS,
Illinois State Water Survey, Urbana.
N. G. Bhowmik, and J. B. Stall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140841, Water Resources Center, University of Illinois, Urbana Research Report No 145, September 1979, 147 p, 120 Fig, 6 Tab, 64 Ref, Append. OWRT B-100-ILL(3), 14-34-0001-7153.

Descriptors: *Floodplains, *Hydraulic geometry, Stream order, Cross-sections, Depth, Width, Carrying capacity, Floods, Humid areas, Streams, Hypsometric analysis, Incision, Flow duration.

Hydraulic geometry relationships for floodplains of nine river basins in Illinois and four river basins outside of the state were developed. Relationships between floodplain width, cross-sectional area, surface area, depth, sinuosity, incision, and stream order have been developed. These hydraulic ge-

ometry parameters were also found to be related to the drainage area of the individual stream segments. Hydraulic geometry coefficients of the floodplains of Illinois streams were found to be similar although the developed relationships have different base values. Hypsometric analyses of the Illinois streams indicated that most of the stream in Illinois are in a mature stage of development. All of the hydraulic geometry parameters of the floodplains increased in the downstream direction. However, for some rivers, the cross-sectional areas showed an increase in the downstream direction up to a certain distance and then it decreased to some extent near the mouth of the river. Comparison of the hydraulic geometry parameters of the floodplains and the main streams indicated that the hydraulic geometry parameters of the floodplains increased at a lower rate in the downstream direction than did the corresponding parameters of the main streams. Actual field data related to the carrying capacity of floodplains were analyzed to determine the distribution of flow in the main channel and in the floodplains. The carrying capacity of floodplains can vary anywhere from a few percent to more than 80 percent of the total flow for the data analyzed for this research.
W80-03172

ESTIMATING MICRO-RELIEF SURFACE STORAGE FROM POINT DATA,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1073-1077, September-October 1979. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Runoff, *Depression storage, *Soil surfaces, *Model studies, Mathematical models, Surface drainage, Storage, Soils, Infiltration, Depression, Rainfall, Farm management, Agriculture, Agricultural runoff, Micro-relief surface storage.

A distributed model for calculating surface storage and runoff amounts for a plot from grid elevations was developed. The model, which operates independently of rainfall and infiltration rates, was applied to field observations on 16 plots, before and after rainfall application. The results showed that limited runoff occurs concurrently with buildup of micro-relief storage. Percent of area contributing runoff increases by steps. Micro-relief storage was increased 3 to 4 times by plowing, but was substantially reduced by subsequent rainfall. (Sims-ISWS)
W80-03179

EVALUATION OF TVA STREAMFLOW MODEL ON SMALL KENTUCKY WATERSHEDS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. R. Nuckols, and C. T. Haan.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1097-1105, September-October 1979. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Streamflow, *Runoff, *Watersheds(Basins), *Kentucky, *Mathematical models, Model studies, Evaluation, Flow, Storm runoff, Rainfall, Evapotranspiration, Drainage, Groundwater, Streams, Rivers, Hydrology.

The TVA Daily Streamflow Simulation Model was evaluated on six Kentucky watersheds. Results indicate that the model is reasonably easy to apply and produces simulation results that are in fair agreement with daily flows and good agreement with monthly and annual flows. (Sims-ISWS)
W80-03182

RELATIONSHIPS BETWEEN STREAM DISCHARGE AND YIELD OF DISSOLVED SUBSTANCES FROM A COLORADO MOUNTAIN WATERSHED,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 5B.
W80-03191

A SIMPLIFIED MODEL FOR THE GENERATION OF DAILY STREAMFLOWS,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
D. M. Sargent.
Hydrologic Sciences Bulletin, Vol 24, No 4, p 509-527, December 1979. 14 Fig, 5 Tab, 7 Ref.

Descriptors: *Streamflow, *Hydrology, *Streamflow forecasting, Hydrographs, Model studies, Analytical techniques, Hydrologic data, Mathematical models, Flow measurement, Computer models, Statistical methods, River flow, *Streamflow data, *England, Daily flow model.

A technique for generating sequences of daily streamflows was presented which preserves the important characteristics of the daily flow hydrograph by the use of a number of simple processes. The daily flow model was applied, in conjunction with a disaggregation model to preserve statistics of monthly and annual flows, to historic data for a river in the northwest of England. Several sets of synthetic data generated by the model were tested for their acceptability. (Lee-ISWS)
W80-03195

TECHNIQUES FOR REAL-TIME OPERATION OF FLOOD CONTROL RESERVOIRS IN THE MERRIMACK RIVER BASIN,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6B.
W80-03198

ADJUSTMENT OF PEAK DISCHARGE RATES FOR URBANIZATION,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 2A.
W80-03200

DEVELOPMENT OF GENERALIZED FREE SURFACE FLOW MODELS USING FINITE ELEMENT TECHNIQUES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2H.
W80-03201

DESIGN OF FLOOD CONTROL IMPROVEMENTS BY SYSTEMS ANALYSIS: A CASE STUDY,
Hydrologic Engineering Center, Davis, CA.
H. O. Reese, A. V. Robbins, J. R. Jordan, and H. V. Doyal.
Technical Paper No 51, October 1971. 21 p, 6 Fig, 2 Ref.

Descriptors: *Flood control, *Systems analysis, *Mississippi, *Model studies, Flood damage, Hydrologic aspects, Economics, Mathematical models, Design, Analytical techniques, Methodology, Channel improvement, Flood protection, Stream improvement, *Tibbee River(MS), Case study.

A hydrologic-economic simulation model was developed to evaluate alternative protection schemes in the design of an authorized federal flood control project for 125 miles of the Tibbee River Flood plain in Mississippi. The model requires input consisting of unit hydrographs, streamflow routing coefficients and storage functions, a pattern storm, rainfall loss rate functions, and flow-damage-frequency relations. A single synthetic pattern storm was used in conjunction with flow-frequency curves at index locations to generate a series of floods for comparing alternative protection schemes with existing conditions. The effect of channel improvements on flood runoff characteristics was evaluated by using storage routing functions that account for changes in storage-discharge relations. Upstream channel improvement works for flood control would tend to increase the magnitude of peak flow rates now experienced on the Tibbee River main stem. They would also tend to increase the average annual flood damages on the main stem unless it was enlarged to accommodate the increased discharges. (Humphreys-ISWS)
W80-03203

EFFECTS OF DAM REMOVAL: AN APPROACH TO SEDIMENTATION,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2J.
W80-03204

DIRECT RUNOFF HYDROGRAPH PARAMETERS VERSUS URBANIZATION,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 2A.
W80-03205

THE EVALUATION OF A HYDRODYNAMIC WATERSHED MODEL (IHW MODEL IV), A CONTRIBUTION TO THE INTERNATIONAL HYDROLOGICAL DECADE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-03206

2F. Groundwater

THE SIMULATION OF TRANSMISSIVITY, STORATIVITY AND EVAPOTRANSPIRATION IN A DIGITAL MODEL OF A FISSURED DOLOMITE AQUIFER NEAR NDOLA, ZAMBIA,
Institute of Geological Sciences, Wallingford (England).
B. Adams, and R. Kitching.
Hydrological Sciences Bulletin, Vol 24, No 4, p 487-498, December 1979. 9 Fig, 1 Tab, 5 Ref.

Descriptors: *Evapotranspiration, *Simulation analysis, *Transmissivity, Digital computers, Dolomite, Karst, Fissures(Geologic), Aquifers, Rainfall, Calibrations, *Storativity, *Karstic aquifers, *Zambia, Digital model, Fissured dolomite, Dolomite aquifers, Kakontwe dolomite, Field evidence, Soil moisture deficits, Polygonal nodal system.

The application of nonlinear transmissivity and storativity functions in a digital groundwater model of a fissured dolomite near Ndola, Zambia, was described. A digital model calibration problem was solved by using methods based on a knowledge of field conditions. The transmissivity and storativity functions were adequate to model the third spatial coordinate in what was essentially a two-dimensional (in space) mathematical solution to a natural phenomenon, i.e., groundwater flow through a karstic aquifer. These functions were based on an understanding of the behavior of karstic aquifers and evidence from borehole logs within the area. The use of root constants and of the facility of modeling soil moisture deficits, and hence actual evapotranspiration, was also a logical and justifiable technique for the construction of digital models of aquifer systems. (Roberts-ISWS)
W80-03033

GROUNDWATER: NEW DIRECTIONS--WHERE WE'VE BEEN AND WHERE WE'RE GOING,
R. G. Kazmann.
Journal of Hydrology, Vol 43, No 1/4, p 555-569, October 1979. 10 Ref.

Descriptors: *Groundwater, *Research and development, *Aquifer management, *United States, Hydrogeology, History, Documentation, Publications, Groundwater resources, Brine disposal, Waste disposal, Water storage, Hydraulics, Saline water intrusion, Model studies, Underground storage, Natural gas storage, Heat storage.

During Burke Maxey's lifetime the potentiometric analysis of groundwater problems, pioneered by Theis, was completely worked out by theoreticians. Such 'macro-methods' are now taught in universities and are widely used. In the future they will be supplemented by 'micro-methods' that are site specific and best described as involving miscible displacement: a well-known application is the leach mining of copper or uranium. Saline aquifers are already used for the storage of natural gas and as permanent containments for liquid wastes.

Future uses of such aquifers will include storage of freshwater and, possibly more important, storage of hot water (water that has been heated by waste heat from generating plants or industrial plants) for later retrieval and use in space heating and other applications of low-grade heat. All of these possibilities offer unexplored fields of research to the imaginative and innovative investigator. All of these possibilities offer an unexcelled opportunity for failure. The era of the use of miscible displacement in porous media is just beginning. (Humphreys-ISWS)
W80-03037

DEPRESSURIZATION OF A MULTI-LAYERED ARTESIAN SYSTEM FOR WATER AND GROUT CONTROL DURING DEEP MINE-SHAFT DEVELOPMENT,
Dames and Moore, Phoenix, AZ.
W. M. Greenslade, and G. W. Condrat.
Journal of Hydrology, Vol 43, No 1/4, p 517-536, October 1979. 4 Fig, 7 Tab, 5 Ref.

Descriptors: *Mining, *Mine water, *Dewatering, *New Mexico, Pumping, Drawdown, Aquifers, Artesian aquifers, Groundwater, Groundwater movement, Velocity, Pressure, Geology, On-site investigations, Hydrology, Depressurization, Mine shafts, Uranium mining.

Uranium in the Grants Mineral Belt of northwestern New Mexico is explored from progressively greater depths. As mining depths increase, more aquifers and higher hydrostatic heads are encountered. Water control during mine shaft sinking is critical to successful shaft development. Field testing procedures were designed to produce data on aquifer coefficients, groutability, and rock strength appropriate to the short-term construction period involved in shaft sinking. Design coefficients were selected on the basis of field and laboratory test results and regional geohydrology. The uranium ore is located between 915 and 1220 m (3000 and 4000 ft) below the surface. The geology of the area studied comprises alternating marine and nonmarine sandstone, siltstone, and shale. The ore is located in the lowermost of six major aquifers identified. A depressurizing system was designed to reduce the hydrostatic pressure and shaft water inflow from each of the aquifers. The groundwater velocity across the shaft was maintained below 0.61 m/day (2 ft/day) and minimized movement of grout away from the shaft. (Sims-ISWS)
W80-03038

GEOTHERMAL WELL TESTING,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Journal of Hydrology, Vol 43, No 1/4, p 537-553, October 1979. 10 Fig, 15 Ref, DOE W-7405-Eng-48.

Descriptors: *Geothermal studies, *Thermal water, *Wells, *Test wells, Aquifer testing, Thermal springs, Temperature, Pressure, On-site investigations, Equipment, Flow, Groundwater, Geology, Hydrogeology, Geothermal wells, Well testing.

Just as in the case of hydrogeology and petroleum engineering, well testing is an invaluable tool in assessing the resource deliverability of geothermal reservoirs. While the techniques of production testing and interference testing already developed in hydrogeology and petroleum engineering provide a strong foundation for geothermal well testing, the latter is challenged by some special problems. These special problems stem primarily from the difficulties associated with the measurement of mass flow rate, pressure, and temperature under the hostile environment prevalent within geothermal wells. This paper briefly looked into the state of the art of geothermal well testing and provided a few illustrative field examples. (Sims-ISWS)
W80-03039

SIMULATED CHANGES IN POTENTIOMETRIC LEVELS RESULTING FROM GROUNDWATER DEVELOPMENT FOR PHOSPHATE MINES, WEST-CENTRAL FLORIDA,
Geological Survey, Tampa, FL.
W. E. Wilson, and J. M. Gerhart.
Journal of Hydrology, Vol 43, No 1/4, p 491-515, October 1979. 13 Fig, 1 Tab, 10 Ref.

Descriptors: *Potentiometric level, *Computer models, *Florida, *Pumping, *Phosphates, *Mining, Transmissivity, Storage coefficient, Hydraulic conductivity, Water table, Steady flow, Unsteady flow, Model studies, Aquifers, Water yield, Floridan aquifer.

A digital model of two-dimensional groundwater flow was used to predict changes in the potentiometric surface of the Floridan aquifer resulting from groundwater development for proposed and existing phosphate mines during 1976-2000. The modeled area covers 15,379 sq km in west-central Florida. In 1975, groundwater withdrawn from the Floridan aquifer for irrigation, phosphate mines, other industries, and municipal supplies averaged about 28,500 l/s. Withdrawals for phosphate mines are expected to shift from Polk County to adjacent counties to the south and west, and to decline from about 7,620 l/s in 1975 to about 7,060 l/s in 2000. The model was calibrated under steady-state and transient conditions. Input parameters included aquifer transmissivity and storage coefficient; thickness, vertical hydraulic conductivity, and storage coefficient of the upper confining bed; altitudes of the water table and potentiometric surface; and groundwater withdrawals. Simulation of November 1976 to October 2000, using projected combined pumping rates for existing and proposed phosphate mines, resulted in a rise in the potentiometric surface of about 6 m in Polk County, and a decline of about 4 m in parts of Manatee and Hardee counties. (Visocky-ISWS)
W80-03040

CONNECTOR WELLS, A MECHANISM FOR WATER MANAGEMENT IN THE CENTRAL FLORIDA PHOSPHATE DISTRICT,
LaMoreaux (P. E.) and Associates, Inc., Tuscaloosa, AL.
For primary bibliographic entry see Field 4B.
W80-03041

THE IMPACTS OF COAL STRIP MINING ON THE HYDROGEOLOGIC SYSTEM OF THE NORTHERN GREAT PLAINS: CASE STUDY OF POTENTIAL IMPACTS ON THE NORTHERN CHEYENNE RESERVATION,
Nevada Univ. System, Las Vegas. Water Resources Center.
For primary bibliographic entry see Field 5B.
W80-03042

PROBLEMS OF LARGE-SCALE GROUNDWATER DEVELOPMENT,
Hebrew Univ., Jerusalem (Israel). Center for Groundwater Research.
For primary bibliographic entry see Field 4B.
W80-03043

THE VOLUME-AVERAGED MASS-TRANSPORT EQUATION FOR CHEMICAL DIAGENETIC MODELS,
Illinois Univ. at Urbana-Champaign. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W80-03044

TIME-DEPENDENT SORPTION ON GEOLOGICAL MATERIALS,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 5B.
W80-03045

ARSENIC SPECIES AS AN INDICATOR OF REDOX CONDITIONS IN GROUNDWATER,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2K.
W80-03046

SEASONAL CHEMICAL AND ISOTOPIC VARIATIONS OF SOIL CO2 AT TROUT CREEK, ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. J. Reardon, G. B. Allison, and P. Fritz.
Journal of Hydrology, Vol 43, No 1/4, p 355-371, October 1979. 9 Fig, 22 Ref.

Descriptors: *Soil gases, *Carbon dioxide, *Isotope studies, *Groundwater, Soil water, Soils, Water levels, Sampling, On-site investigations, Data processing, Analytical techniques, Precipitation(Atmospheric), Soil moisture, Water chemistry, Soil carbon dioxide.

The partial pressure of carbon dioxide in soil gas and its 13C isotopic composition were monitored in a sandy calcareous soil during 1977-1978. These measurements were coupled with chemical and isotopic analyses of groundwater from a water-table piezometer. The 13C isotopic composition of the groundwater at the water table is in apparent equilibrium with the soil zone CO2 gas phase. The P sub CO2 is primarily controlled by root respiration, diffusive loss to the atmosphere, and uptake by the aqueous phase. Steep P sub CO2 gradients towards the water table are evident during periods of low CO2 production in the root zone. By early spring, diffusive loss of CO2 along these gradients extends to depths of 7 m or more. During the growing season this gradient is reversed, resulting in CO2 buildup below the root zone. Below a depth of 7 m, soil CO2 content showed little seasonal change. Leaching of soil carbonate extends to depths of 2 m or more in the study area. A rapid neutralization of slightly acid soil water by soil carbonate as the water is displaced across the leached-unleached zone boundary due to recharge events is believed to account for the deposition of iron and manganese oxides at this interface. Saturation of soil water with respect to calcite is attained in the unsaturated zone, and a state of supersaturation is reached by the time the soil water reaches the water table. Two mechanisms may account for this supersaturation: (1) slow dissolution of dolomite by infiltrating soil water after calcite saturation is reached; and (2) CO2 degassing of soil water in response to CO2 losses from the soil profile during fall and winter. (Sims-ISWS)
W80-03047

EVALUATION TECHNIQUES OF FRACTURED-ROCK HYDROLOGY,
H. E. LeGrand.
Journal of Hydrology, Vol 43, No 1/4, p 333-346, October 1979. 4 Fig, 5 Ref.

Descriptors: *Groundwater, *Fractures(Geologic), *Fracture permeability, *Southeast U.S., Rocks, Groundwater movement, Permeability, Geology, Evaluation, Porous media, Hydrogeology, Areal hydrogeology, Hydrology.

Areas in which fractured rocks are part of the hydrologic circulatory system are widespread. Certain aspects of the historical features of hydrology tend to influence fractured rocks, and the results of these influences in turn control certain aspects of applied hydrology. The dynamic changes in the fractured-rock system can be cast in spatial relations that are usefully studied in the field and in the context of their historical development. For example, circulating water in carbonate rocks causes enlargement of fractures by solution and the development of secondary permeability that further influences movement and storage of water; solutes moving in fractures of less soluble rocks control the degree of development of overlying insoluble residue, and to the degree present, this residue forms another type of sub-surface water medium that must be considered with the fractured-rock system. The treatment of fracture systems of consolidated rocks in a way similar to porous granular media, in a context of fractures analogous to pores strictly a matter of scale, is not an adequate base for analyzing problems of fractured-rock hydrology. A key problem is the uneven distribution of permeability, a condition resulting from geologic and hydrologic processes since consolidation of the rock. Classifying the patterns of uneven distribution lead to appropriate models on which useful mean values and devi-

ations can be described. Reconstruction of the hydrogeologic history of a fractured-rock system provides an elegant foundation for the evaluation of the existing hydrology. (Sims-ISWS)
W80-03049

REGIONAL CARBONATE FLOW SYSTEMS IN NEVADA,
Nevada Univ. System, Las Vegas. Water Resources Center.
M. D. Mifflin, and J. W. Hess.
Journal of Hydrology, Vol 43, No 1/4, p 217-237, October 1979. 4 Fig, 3 Tab, 42 Ref.

Descriptors: *Groundwater, *Aquifers, *Carbonate rocks, *Nevada, *Great Basin, Water supply, Water resources, Geology, Stratigraphy, Permeability, Caves, Wells, Springs, Bedrock, Groundwater movement, Water chemistry, Dissolved solids, Tritium, Hydrology, Hydrogeology.

Carbonate rocks include some of the most extensive and productive aquifers in the world. In Nevada, the limited surface water supply has been extensively developed, and most of the alluvial groundwater basins are used to the point of estimated perennial yield, thus are closed to further development. Based on the review of over 570 geologic/hydrologic references, 150 petroleum wildcat test-hole records, and cave and carbonate spring data, it is believed that deep regional carbonate aquifers exist and that they are potentially favorable for development for water supplies. Approximately the eastern one-third of Nevada (105,000 sq km) is underlain by carbonate rock. Eastern Nevada lies within the miogeosynclinal belt of the cordilleran geosyncline, in which 9,000-12,000 m of marine sediments accumulated during the Precambrian and Paleozoic. Two major periods of deformation have affected the region. Cave, wildcat well, and carbonate spring data indicate that the Cambrian and Devonian carbonate strata may generally have the highest permeability. Water quality at depth in general ranges between 300 and 600 mg/l TDS. A 'Phase II' project has been designed to further these investigations and will increase our understanding of large regional carbonate aquifers in the Great Basin. (Sims-ISWS)
W80-03050

UTILITY OF A COMPUTERIZED DATA BASE FOR HYDROGEOLOGIC INVESTIGATIONS, LAS VEGAS VALLEY, NEVADA,
Office of Radiation Programs, Las Vegas, NV.
R. F. Kaufmann, and H. N. Friesen.
Journal of Hydrology, Vol 43, No 1/4, p 195-216, October 1979. 8 Fig, 1 Tab, 13 Ref, EPA R800946.

Descriptors: *Groundwater, *Data collections, *Data storage and retrieval, *Nevada, Stratigraphy, Permeability, Transmissivity, Water quality, Water balance, Wells, Water wells, Well data, Water levels, Pumping, Drawdown, Storage, Data processing, Computers, Hydrology, Hydrogeology, *Las Vegas(NV).

Hydrogeologic study of the shallow groundwater zone in Las Vegas Valley, Nevada, involved development of an extensive computerized data base consisting of water analyses and water-well logs. The data were manipulated and reduced using a variety of graphical and statistical techniques applicable to analysis of spatial and temporal changes in water quality. Stratigraphic relations, permeability/transmissivity variations, water budgets, and ambient quality relative to drinking-water standards were evaluated as part of an overall EPA funded study to determine the sources and extent of groundwater contamination and develop management alternatives to minimize adverse effects. Extension of the data base to include investigations concerned with improved definition of the stratigraphic and structural makeup of the valley and to applied study of water quality, subsidence, and water banking seems reasonable. (Sims-ISWS)
W80-03051

MEASUREMENT OF FLUID VELOCITY USING TEMPERATURE PROFILES: EXPERIMENTAL VERIFICATION,
Illinois State Geological Survey, Urbana.
K. Cartwright.
Journal of Hydrology, Vol 43, No 1/4, p 185-194, October 1979. 5 Fig, 12 Ref.

Descriptors: *Groundwater movement, *Velocity, *Water temperature, *Illinois, Wells, Water wells, Groundwater, On-site investigations, Test wells, Geology, Aquifers, Heat, Heat transfer, Temperature, Hydraulic conductivities, Hydrology, Temperature profiles.

Temperature profiling has been used to predict the rate and direction of groundwater movement. A controlled field experiment was conducted to ascertain the validity of the rate calculations made using this method. The vertical velocity, or leakage, of groundwater between two aquifers was calculated utilizing both hydrologic and temperature measurements in a well drilled into the Paw Paw buried bedrock valley in northern Illinois. The experiment showed that accurate estimates of leakage can be made in stable boreholes where there are no geologic complications. Estimates utilizing temperature and hydrologic methods produced similar results for one of two aquicludes. However, the methods produced dissimilar results for the second aquiclude. It was speculated that the presence of a thin organic silt caused most of the problem; other complicating factors were lithologic variation and a very low hydraulic gradient. Nevertheless, the method appears to have great promise in many geologic environments. (Sims-ISWS)
W80-03052

PROGRESS IN ANALYTICAL GROUNDWATER MODELING,
Upper Mississippi River Basin Commission, Twin Cities, MN.
W. C. Walton.
Journal of Hydrology, Vol 43, No 1/4, p 149-159, October 1979. 4 Tab, 47 Ref.

Descriptors: *Mathematical models, *Groundwater, *Analytical techniques, *Reviews, Model studies, Wells, Water wells, Groundwater movement, Aquifers, Artesian aquifers, Injection wells, Hydrology.

Analytical models simulating the flow of groundwater to and from wells and streams, land subsidence due to artesian pressure decline, conservative solute transport to and from wells, and heat transport to and from wells have been developed for many aquifer systems, well and stream conditions. These models are useful, though limited in application, for aquifer-test analysis, simple aquifer system evaluation, and numerical computer model design and calibration. Accelerated progress in analytical model development and application is called for particularly regarding flow in leaky artesian aquifers, conservative and nonconservative solute transport and transfer, and heat transport. (Sims-ISWS)
W80-03053

THE MEINZER ERA OF U.S. HYDROGEOLOGY, 1910-1940,
Nevada Univ. System, Reno. Desert Research Inst.
G. B. Maxey.
Journal of Hydrology, Vol 43, No 1/4, p 1-6, October 1979. 10 Ref.

Descriptors: *Hydrogeology, *United States, *History, *Groundwater, Documentation, Publications, Analytical techniques, Groundwater movement, Hydrologic budget, Groundwater resources, Meinzer era.

Acceleration of agricultural, industrial, and municipal development following the American Civil War resulted in unprecedented demands for knowledge of movement, occurrence, quality, and availability of groundwater. By 1910, response to this demand resulted, in government, in establishment of specialized agencies. The agency most affecting development of hydrogeology was the Ground Water Division of the U.S. Geological Surve, especially after appointment of O.E. Meinzer as Chief in 1912. The Division established a system utilizing geologists and engineers (later other scientists) working as teams to assess groundwater resources. The U.S. Geological Survey developed cooperative programs allowing State Engineers and geologists to participate in resource studies, an effective way of encouraging interest in hydrogeological problems as well as establishing a strong funding base. By 1940, resource evaluation studies numbered into the hundreds and, more important, a sound scientific and engineering basis for hydrogeology was established. Contributions were made by scientists in the petroleum industry chiefly in movement of fluids through porous media (works of M. Muskat and M.K. Hubbert and associates). Also C.F. Tolman and associates made contributions in special areas (water supply, saltwater intrusion, land subsidence). By 1940, qualitative hydrology was well developed and documented, and a firm base for quantitative work was established. Contributions were made to specialized studies including budget methods, subsidence, saltwater intrusion, pumping effects, model development, and water quality. Printed summations of the 'state of the art' in 1940 include O.E. Meinzer in Physics of the Earth (1942) and Tolman's Groundwater of 1937. (Humphreys-ISWS)
W80-03054

GROUNDWATER FLOW SYSTEMS IN THE WESTERN PHOSPHATE FIELD IN IDAHO,
Idaho Univ., Moscow. Mining and Mineral Resources Research Inst.
D. R. Ralston, and R. E. Williams.
Journal of Hydrology, Vol 43, No 1/4, p 239-264, October 1979. 13 Fig, 3 Tab, 6 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Phosphates, *Mining, *Idaho, Geology, Groundwater flow, Baseflow, Springs, *Subsurface drainage, Discharge(Water), Water quality, Mine wastes, Phosphorus, Phosphorus compounds, Aquifers, Hydrology, *Blackfoot River Basin(ID).

The complex geologic setting of the western phosphate field in Idaho provides the environment for equally complex groundwater flow systems. This research was initiated in 1974 to provide general and detailed hydrologic data on specific areas to aid in understanding the water-resource systems in the western phosphate field. Geologic, hydrogeologic, and hydrologic data were collected in Little Long Valley and Lower Dry Valley in the Blackfoot River Basin. Two groundwater flow systems are important in relation to the present and proposed mining in Little Long Valley: (1) the local shallow flow systems in the western ridge; and (2) the intermediate flow system in the Dinwoody Formation on the eastern ridge. The baseflow of Angus Creek in Little Long Valley is dependent on the groundwater flow systems in both ridges during the first one or two months following snowmelt. The baseflow of the stream is almost completely dependent on the intermediate flow system in the eastern ridge for the rest of the year. Care must be taken to avoid creating groundwater flow systems in any waste piles constructed as part of the mining activity. Drainage from a waste-pile flow system would probably be poorer quality than water from natural flow systems in the area. (Sims-ISWS)
W80-03055

POTENTIOMETRIC SURFACE OF THE MISSISSIPPIAN AQUIFER IN PARTS OF TRIGG, LYON, CALDWELL, AND CHRISTIAN COUNTIES, MISSISSIPPIAN PLATEAU REGION, KENTUCKY,
Geological Survey, Paducah, KY. Water Resources Div.
R. O. Plebuch.
Geological Survey Water-Resources Investigations 78-25 (open-file report), 1978. 3 Sheets, 17 Ref.

Descriptors: *Potentiometric level, *Kentucky, *Maps, *Contours, *Groundwater movement, Karst, Drilling, Depth, Bedrock, Sandstones, Limestones, Domestic water, Livestock, Water pollution, Water quality, *Mississippian Plateau Region(KY), Mississippian aquifer(KY), Cumberland River basin(KY), Lake Barkley(KY).

Ground-water levels in a 600 square mile area of the Cumberland River drainage basin in parts of Trigg, Lyon Caldwell, and Christian Counties, Mississippian Plateau Region, Kentucky are shown by means of contours on the potentiometric surface. Generaly, ground water moves toward and with the surface drainage to Lake Barkley and the Cumberland River. The potentiometric map indicates a minimum drilling depth to water. The bedrock is composed largely of sandstone, cavernous limestone, or jointed and fractured limestone. All of these rock types yield sufficient water for domestic and stock purposes. The cavernous limestone is extremely vulnerable to pollution. (Kosco-USGS)
W80-03155

AVAILABILITY AND QUALITY OF WATER FROM SHALLOW AQUIFERS IN DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
L. V. Causey, and G. G. Phelps.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A075 819, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-92, 1978. 36 p, 11 Fig, 7 Tab, 20 Ref.

Descriptors: *Groundwater availability, *Water quality, *Aquifer systems, *Florida, *Aquifer characteristics, Hydrogeology, Groundwater recharge, Analytical techniques, Aquifer testing, Sites, Water yield, Transmissivity, Petrology, Domestic water, Industrial water, *Floridan aquifer, *Duval County(Fla), *Jacksonville(Fla).

The shallow-aquifer system in Duval County, Fla., overlies the Florida aquifer and is composed chiefly of sand, clay, sandy clay, and limestone. Thickness of the system ranges from about 300 to 600 feet. The upper 150 feet of deposits, consisting of the water-table and shallow-rock zones, are the most dependable and economical source of supplemental water supply. The principal shallow water-bearing zone is a limestone bed 40 to 100 feet below land surface. Aquifer tests conducted at 13 sites in Duval County show that yields from the shallow aquifer vary from place to place within the county owing chiefly to variations in lithology of the saturated rocks and sediments. The limestone of the shallow-rock zone will yield as much as 200 gallons per minute to wells; the maximum yield at most of the sites tested was between 30 and 100 gallons per minute. The water-table zone generally yields 10 gallons per minute or less but at one site, where a water-table well tapped a shell bed near land surface, the well yielded more than 40 gallons per minute. The quality of water in the shallow aquifer system in Duval County is generally acceptable for most domestic, commercial, and industrial uses. In some places, however, it has a high iron concentration and is hard. The iron concentration exceeds 0.3 milligrams per liter in water from the water-table or shallow-rock zones at 7 of the 13 aquifer test sites. The hardness of water from the aquifer ranges from about 60 to about 180 milligrams per liter. (Kosco-USGS)
W80-03157

ESTIMATED DRAWDOWNS IN THE FLORIDAN AQUIFER DUE TO INCREASED WITHDRAWALS, DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-03165

GROUND-WATER TRACERS--A SHORT REVIEW,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. N. Davis, G. M. Thompson, H. E. W. Bentley, and G. Stiles.
Ground Water, Vol 18, No 1, p 14-23, January-February 1980. 1 Fig, 3 Tab, 39 Ref.

Descriptors: *Groundwater, *Groundwater movement, *Tracers, *Reviews, Suspended solids, Spores, Bacteria, Dyes, Dye releases, Water temperature, Chemicals, Stable isotopes, Radioisotopes, Gases, Hydraulic conductivity, Hydrology, Fluorocarbons.

Tracers are used widely to determine the direction and velocity of groundwater movement. Failures of tracer tests are most commonly a result of incorrect choice of tracers, insufficient concentrations of tracers, and a lack of an understanding of the hydrogeologic system being tested. Some of the most useful general tracers are bromide, chloride, rhodamine WT, and various fluorocarbons. For certain purposes, dyed club-moss spores and baker's yeast have proved valuable. Many radionuclides including 3H, 82Br, and 198Au are almost ideal for numerous purposes, but radiation hazards associated with their use together with local, State, and Federal regulations have discouraged widespread field applications in recent years within the United States. (Sims-ISWS)
W80-03187

GRAVITY SURVEY OF A DEEP BURIED VALLEY,
South Florida Univ., Tampa. Dept. of Geology.
M. T. Stewart.
Ground Water, Vol 18, No 1, p 24-30, January-February 1980. 9 Fig, 1 Tab, 17 Ref.

Descriptors: *Gravity studies, *Groundwater, *Aquifers, Sands, Gravels, Bedrock, Geology, Data collections, On-site investigations, Data processing, Well data, Water wells, Water resources, Hydrology, *Outagamie County(WI).

A gravity survey was conducted as part of a groundwater investigation covering 400 sq mi (1,000 sq km) in Outagamie County, northeastern Wisconsin. The objective of the gravity survey was to supplement bedrock topography data obtained from well logs and seismic refraction profiles. The gravity method was chosen as it is a rapid and low cost reconnaissance technique, and conditions in the study area were favorable for a successful gravimetric survey. The simple Bouguer gravity values were referenced to a local base station as only relative gravity values were required. The data were interpolated to a regular grid by an inverse-distance weighted average algorithm. The gravity residual was derived using a five-ring inverse weighted filtering routine. The residual map accurately reflects the major topographic features of the bedrock surface. A two-dimensional geologic model fitted to the residual data agrees well with the simple flat plate approximation used to obtain quantitative estimates of glacial drift thickness. Estimates of drift thickness from the gravity data also agree wellwith bedrock depths obtained from well logs. The most productive drift aquifers are restricted to the major bedrock valleys. Gravity data were coupled with seismic refraction and well data to produce a bedrock elevation map, from which it is possible to predict the extent and distribution of the major drift aquifers. (Sims-ISWS)
W80-03188

GROUND-WATER SALINITY PROBLEMS RELATED TO IRRIGATION IN THE COLORADO RIVER BASIN,
Tennessee Valley Authority, Norris, TN. Office of Natural Resources.
For primary bibliographic entry see Field 5G.
W80-03189

POTENTIAL USE OF DIGITAL COMPUTER GROUND WATER MODELS,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
D. L. Gundlach.
Technical Paper No 52, April 1978. 34 p, 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Model studies, *Groundwater, *Aquifers, *Systems analysis, *New Mexico, Computer models, Water quality, Mathematical models, Costs, Groundwater movement, Aquifer systems, Aquifer characteristics, Hydraulic conductivity, Groundwater recharge, Flow system, *Albuquerque(NM), Two-dimensional model, Three-dimensional model.

The discussion on the potential use of digital computer groundwater models was prepared for the Albuquerque District, Corps of Engineers, Albuquerque, New Mexico, as part of a water supply study of the Albuquerque Greater Urban Area (AGUA). Although the material presented was developed for the Albuquerque area, the concepts are applicable to the understanding of groundwater modeling generally. The discussion included both quantity and quality models and reasons why an agency may wish to undertake a modeling effort. Available computer programs were cited, and the probable advantages and disadvantages of specific programs were given. Costs for prior modeling efforts of groundwater systems in other localities were also included as a guide to probable costs when considering the use of a digital computer groundwater model. (Humphreys-ISWS)
W80-03202

OCCURRENCE, QUALITY, AND QUANTITY OF GROUND WATER IN WILBARGER COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W80-03209

2G. Water In Soils

MODEL DEVELOPMENT FOR PREDICTING SOIL MOISTURE BY THERMOGRAPHY,
South Dakota State Univ., Brookings. Dept. of Physics.
For primary bibliographic entry see Field 7B.
W80-03007

SEASONAL CHEMICAL AND ISOTOPIC VARIATIONS OF SOIL CO2 AT TROUT CREEK, ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W80-03047

SOIL SEDIMENT DEPOSITS IN SUBSURFACE DRAINS,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
For primary bibliographic entry see Field 4A.
W80-03178

ESTIMATING MICRO-RELIEF SURFACE STORAGE FROM POINT DATA,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W80-03179

SIMULATION OF NITROGEN AND PHOSPHORUS LEACHING FROM POULTRY MANURE,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03181

LANDSLIDE-PRONE SOILS OF SOUTHWESTERN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
E. J. Ciolkosz, G. W. Petersen, and R. L. Cunningham.
Soil Science, Vol 128, No 6, p 348-352, December 1979. 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Landslides, *Expansive clays, *Regression analysis, *Pennsylvania, *Soil profiles, *Ohio, *West Virginia, *Kentucky, Statistical methods, Wetting, Drying, Soil analysis, Slow flowage, Sliding, Slickensides, Clay content.

Upshur, Vandergrift, Guernsey, and Library soils are found in southwestern Pennsylvania and in Ohio, West Virginia, and Kentucky. These soils have high clay contents, high COLE values, and

slickensides, and are landslide-prone. The movement caused by the wetting and drying of expandable clays, combined with gravitational forces, initiates the downslope soil movement and the formation of slickensides. Cavode and Wharton soils also have high clay contents, but they are not landslide-prone. The clay mineralogy of the landslide-prone soils is of an expandable type, and that of the cavode and Wharton is primarily nonexpandable. Thus the landscape instability of the landslide-prone soils is a function of high clay content, with a high proportion of the clay being of an expandable type. (Visocky-ISWS)
W80-03190

SORPTION OF WATER IN SOILS: A COMPARISON OF TECHNIQUES FOR SOLVING THE DIFFUSION EQUATION,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
D. E. Elrick, and K. B. Laryea.
Soil Science, Vol 128, No 6, p 369-374, December 1979. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Sorption, *Soil water movement, *Unsaturated flow, *Mathematical models, *Computer programs, Numerical analysis, Diffusion, Equations, Soil water, Simulation analysis, Absorption, *Continuous System Modeling Program(CSMP), Quasi-analytical solution, Perturbation technique.

The flow of water in unsaturated soils is governed by the nonlinear diffusion equation. Four different methods for solving this equation were compared. Results within 1% of one another were generally obtained. An improved simulation procedure was described in detail. (Visocky-ISWS)
W80-03192

2H. Lakes

A THEORY OF THE MEAN FLOW DRIVEN BY LONG INTERNAL WAVES IN A ROTATING BASIN, WITH APPLICATION TO LAKE KINNERET,
Woods Hole Oceanographic Institution, MA. Joint Program in Physical Oceanography.
H. W. Ou, and J. R. Bennett.
Journal of Physical Oceanography, Vol 9, No 6, p 1112-1125, November 1979. 12 Fig, 9 Ref, BNL 357213-S,NOAA 03-022-57, NSF OCE76-01813.

Descriptors: *Lakes, *Water circulation, *Internal waves, *Model studies, Theoretical analysis, Mathematical models, Thermocline, Winds, Temperature, Water temperature, Limnology, *Lake Kinneret(Israel), Kelvin waves.

The rectified flow induced by wind-driven internal seiches in a rotating lake was studied. Friction and nonlinearity combine to generate a secondary mean flow which was calculated analytically for the case of a uniform depth lake and numerically for variable depth. The theory was applied to Lake Kinneret, the former Sea of Galilee, where the diurnal wind forcing produces a large internal Kelvin wave and which has a strong cyclonic mean flow. The uniform depth model reproduces the diurnal response adequately, but variable depth is required to reproduce the mean flow. (Sims-ISWS)
W80-03032

AMAZON LAKES: WATER STORAGE AND NUTRIENT STRIPPING BY ALGAE,
Duke Univ., Beaufort, NC. Marine Lab.
For primary bibliographic entry see Field 5C.
W80-03108

OXYGEN DEFICIT--PHOSPHORUS LOADING RELATION IN LAKES,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5B.
W80-03185

IMPACT OF DEVELOPMENT ON WATERSHED HYDROLOGIC AND NUTRIENT BUDGETS,
Wisconsin Univ.-Madison. Center for Biotic Systems.
For primary bibliographic entry see Field 5B.
W80-03186

DEVELOPMENT OF GENERALIZED FREE SURFACE FLOW MODELS USING FINITE ELEMENT TECHNIQUES,
Hydrologic Engineering Center, Davis, CA.
D. M. Gee, and R. C. MacArthur.
Technical Paper No 53, July 1978. 18 p, 12 Fig, 4 Tab, 14 Ref.

Descriptors: *Mathematical models, *Finite element analysis, *Free surfaces, Hydrodynamics, Model studies, Equations, Flow, Analytical techniques, Analysis, Velocity, Reservoirs, Distribution patterns, Open channel flow, Continuity equation, Momentum equation.

Two finite element hydrodynamic models, one for two-dimensional free surface flow in the horizontal plane and one for the vertical plane, are being evaluated. This paper presented recent results of evaluation and application of the models. The work to date with the horizontal flow model indicates the following: (1) Internal continuity errors can be reduced to acceptable levels by increasing network detail, particularly in areas of large curvature of the velocity field. (2) Errors in continuity tend to be reflected more strongly in the velocity than the depth. (3) General application of the model to steady state simulations is feasible at present. The preliminary work with the vertical flow models indicates the following: (1) The finite element method model is less costly than the finite difference model for steady state solutions. (2) Simulation of flows in which density gradients are important requires careful selection of turbulent exchange and eddy diffusion coefficients. (3) The finite element model predicts larger vertical velocities than the finite difference model, perhaps due to the retention of the vertical momentum equation. (4) More experience with, and development of, the vertical models will be required before 'production' applications can be easily made. Indicated areas of further work are: (1) Verification of models' performance when an adequate data set becomes available. (2) Development of guidance on selection of turbulent exchange coefficients, relationship to flow properties, etc. (3) Investigation of models' behavior for dynamic simulations. (4) Evaluation of use of stagnation vs. slip boundary conditions in the finite element models. (5) Extension of simulations with the vertical models to variable breadth problems. (Humphreys-ISWS)
W80-03201

2I. Water In Plants

FOREST OVERSTORY VEGETATION AND ENVIRONMENT ON THE MISSOURI RIVER FLOODPLAIN IN NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Botany.
W. C. Johnson, R. L. Burgess, and W. R. Keammerer.
Ecological Monographs, Vol 46, No 1, p 59-84, Winter, 1976. 11 Fig, 8 Tab, 82 Ref. OWRT A-022-NDAK(4).

Descriptors: *Missouri River, *Flood plains, *Forests, *Trees, *Ecology, Rooted aquatic plants, Wetlands, Rivers, Ecological distribution, Succession, Meanders, Soils, Floods, Nutrients, Reservoirs.

Structure and composition of forest overstory are strongly related to stand age and position on the floodplain. Populus deltoides and Salix amygdaloides predominate in young stands which generally occur on low terraces near the center of the floodplain. Fraxinus pennsylvanica var. lanceolata, Acer negundo, Ulmus americana and Quercus macrocarpa replace Populus and Salix through time and predominate in old stands on high terraces near the edge of the floodplain. The soils of young stands are generally sandy and low in organic matter. Soil nutrient content and available water capacity are generally higher in older stands because of higher organic matter content and repeated inputs of nutrient-rich silts from past floods. Tree species diversity initially increases as stands age and reaches a maximum in stands with mixtures of both pioneer and terminal species. Variety and evenness follow a similar pattern. A recent decline in the establishment of small stems of Acer and Ulmus, a decline in the diameter growth rate for Acer, Ulmus and Fraxinus and a lack of seedling sapling stands of Populus in the region appear to be the result of the presence and operation of reservoirs. (Stihler-Mass)
W80-03168

2J. Erosion and Sedimentation

WILLAMETTE RIVER SEDIMENT MANAGEMENT POSSIBILITIES: PHASE I -- PROBLEM CLARIFICATION,
Oregon State Univ., Corvallis. Water Resources Research Inst.
P. C. Klingeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139611, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, October 1979. 18 p, 8 Ref, 2 Append. OWRT A-999-ORE(24).

Descriptors: *Oregon, *Sediment control, *Information exchange, *River flow, Documentation, Banks, Riparian land, Aggregates, Gravels, Water management(Applied), Project planning, Fisheries, Sediment transport, Sediment distribution, Erosion.

Descriptive materials developed as a part of an information dissemination project on sediment management for the Willamette River in Oregon are presented. Much conflict over the management of the river, its water, bed, and banks has existed for several years. Groups interested in the river include the construction aggregate industry, fishery agencies, recreation groups, and land owners. However, little factual quantitative information on sediment transport and erosion existed so a project was organized to: (1) clarify the sediment transport regime of the river; (2) identify and prioritize the quantitative information required for decisionmaking; and (3) demonstrate what can be done with various kinds of information to improve the basis for decisionmaking. Project activities designed to assemble and disseminate information included workshops, conferences, and news coverage. A copy of a talk, 'Willamette River Challenges', used at a conference is given. In the talk the physical processes shaping the river and the dynamic nature of the processes are discussed. River management approaches and tasks are identified and challenged. Also presented is a composite of presentations made to technical or industrial groups. This document 'Willamette River Gravel -- Resource Management Needs' is more technical than the first and includes specific action recommendations. (Seigler-IPA)
W80-03008

EFFECTS OF STEM DENSITY UPON SEDIMENT RETENTION BY SALT MARSH CORDGRASS, SPARTINA ALTERNIFLORA LOISEL,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 4D.
W80-03026

IMPACTS OF OFF-ROAD VEHICLES ON INFILTRATION AND SEDIMENT PRODUCTION OF TWO DESERT SOILS,
Nevada Univ. System, Reno. Renewable Natural Resources Div.
R. E. Eckert, Jr., M. K. Wood, W. H. Blackburn, and F. F. Peterson.
Journal of Range Management, Vol 32, No 5, p 394-397, Sept 1979, 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Environmental effects, *Desert soils, *Off-road vehicles, *Soil mechanics, *Soil manage-

ment, Recreation, Soil stabilization, Simulated rainfall, Nevada, Infiltration rates, Sedimentation rates.

Although scientists generally agree that off-road vehicle (ORV) traffic is damaging to fragile desert habitats, many of the actual site-specific effects of such activity are unknown. Accordingly, the objective of this study was to evaluate the initial impacts of two types of ORVs: motorcycle and 4-wheel drive traffic, on the infiltration rate and sediment production characteristics of two desert soils in response to simulated rainfall. The study was conducted at two sites in southern Nevada on two major types of surface soils: the coppice soil on the low small dunes under shrubs, and the mostly barren interspace soil between shrubs. Motorcycle (50 passes), truck (20 passes), and control treatments were imposed in August 1975 at both locations, at the Blue Diamond site again in January 1976, and at the Crystal Springs site again in April 1976. Different dates were used in 1976 to obtain similar surface moisture conditions on the two sites at time of treatment. Results indicated that infiltration was similar for both soils although more sediment was produced from the surface with exposed mineral soil than from the gravel-mulched surface. Infiltration was from 3-13 times greater on the coppice soil than on the interspace soil, while sedimentation was 10-20 times greater on the interspace soil. Infiltration was less and sediment yield greater after soil was disturbed by vehicular traffic and after reformation of surface crust, particularly on interspace soil. It is concluded that ORV traffic is a major factor in the management of recreation lands, and ways must be found to reduce the damage. (Tickes-Arizona)
W80-03057

FILTRATION OF SEDIMENT BY SIMULATED VEGETATION II. UNSTEADY FLOW WITH NON-HOMOGENEOUS SEDIMENT,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W80-03177

SOIL SEDIMENT DEPOSITS IN SUBSURFACE DRAINS,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
For primary bibliographic entry see Field 4A.
W80-03178

TILLAGE SYSTEM EFFECTS ON SEDIMENT AND NUTRIENTS IN RUNOFF FROM SMALL WATERSHEDS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03183

EFFECTS OF DAM REMOVAL: AN APPROACH TO SEDIMENTATION,
Hydrologic Engineering Center, Davis, CA.
D. T. Williams.
Technical Paper No 50, October 1977. 31 p, 17 Fig, 10 Ref, 1 Append.

Descriptors: *Model studies, *Sediment transport, *Dams, *Idaho, Hydraulic structures, Analytical techniques, Analysis, Rivers, Hydraulics, Mathematical models, Computer models, On-site investigations, Effects, Data collections, Sediment discharge, Particle size, Streambeds, Dam removal.

In recent years hydraulic structures such as dams have been removed due to deterioration, increased maintenance cost, or obsolescence. Investigation of the hydraulic, hydrologic, and sediment transport consequences of the removal of these structures have been very limited, thus necessitating the establishment of analytical techniques and procedures to predict adequately these effects. A mathematical model (HEC-6) was selected because of its success in the prediction of sediment transport when applied to a wide variety of cases. The removal of the Washington Water Power Dam (WWPD) on the Clearwater River near Lewiston, Idaho, was selected for study. Procedures and techniques of calibration and verification developed, comparison of actual and predicted volume of sediment transported, where the sediment scoured or deposited, and their rates were presented. There was discussion of the applicability of the model to this type of problem, limitations of a one-dimensional model, and interpretation of the results. The comparison of measured and computed final bed elevations, with the dam removed, was very satisfactory. Overall long range trends for each operating condition was as expected. The calculated rate of scour was accurate at the WWPD site (River Mile 4.62) but lagged by approximately ten months at other upstream sections. This difference can be attributed to localized scour and 'layering' of the bed particle distribution. Neither can be modeled by HEC-6. Some of the variations in the rate of scour and deposition can be attributed to the limitations of a one-dimensional model. (Humphreys-ISWS)
W80-03204

2K. Chemical Processes

ARSENIC SPECIES AS AN INDICATOR OF REDOX CONDITIONS IN GROUNDWATER,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
J. A. Cherry, A. U. Shaikh, D. E. Tallman, and R. V. Nicholson.
Journal of Hydrology, Vol 43, No 1/4, p 373-392, October 1979. 8 Fig, 4 Tab, 28 Ref.

Descriptors: *Water chemistry, *Arsenic compounds, *Oxidation-reduction potential, *Groundwater, Chemistry, Chemicals, Indicators, Sampling, Laboratory tests, Hydrogen ion concentration, Electrochemistry, Thermodynamics, Analytical techniques.

Although the thermodynamically based concept of oxidation-reduction potential has for many decades been an accepted tool for interpretation of the chemistry of hydrochemical systems, attempts at measurement of actual redox levels in natural waters have been fraught with difficulty. Existing methods of measurement involve use of potential-sensing inert metal electrodes or analytical determination of redox-indicator species such as dissolved 02 or Fe(2+) or redox couples such as SO4(2-)--HS(-) and HCO3(-)--CH4. As a result of recent advances in analytical methods, it is now possible to determine the concentrations of both As(III) and As(V) at sufficiently low levels so that the apparent redox condition, as pE or Eh, can be computed from measured concentrations of As(III) and As(V) species. The arsenic pE or Eh domain obtained using published thermodynamic data for As species and the assumption of redox equilibrium provides a basis for obtaining an indication of redox levels within the central portion of the redox field for natural waters. The redox domain for the As couple is largest at high total dissolved As concentrations, but even at concentrations as low as 1-10 micrograms/liter the domain has significant extent. Oxidation and reduction of As(III) and As(V) in laboratory trials with redox agents common to natural waters, such as O2, H2S, and Fe, suggest that oxidation or reduction of As species in natural waters occur at rates sufficiently slow to enable water samples to be collected, transported, and analyzed before excessive change in species distribution takes place, but rapid enough for As species to adjust to the dominant redox condition of the water if periods of years or longer are available for equilibration. Because of the long equilibration time and the position of the pE-pH domain for the As couple, groundwater is best suited for use of As as a redox indicator. (Sims-ISWS)
W80-03046

2L. Estuaries

EFFECTS OF STEM DENSITY UPON SEDIMENT RETENTION BY SALT MARSH CORD-GRASS, SPARTINA ALTERNIFLORA LOISEL,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 4D.
W80-03026

TIDAL DYNAMICS AND LOW-FREQUENCY EXCHANGES IN THE ARANSAS PASS, TEXAS,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
N. P. Smith.
Estuaries, Vol 2, No 4, p 218-227, December 1979. 10 Fig, 2 Tab, 14 Ref.

Descriptors: *Tidal waters, *Inlets(Waterways), *Texas, *Gulf of Mexico, Currents(Water), Water levels, Winds, Waves(Water), Tides, Coasts, Data processing, Analytical techniques, Estuaries, *Aransas Pass(TX), Tidal dynamics.

Current, water level and wind data collected from a study site at the Aransas Pass, Texas, during a 45-day period in mid-1977 were used to describe tidal motions and low-frequency, meteorologically-forced exchanges between the inner shelf and a series of intracoastal bays. Analysis of individual tidal constituents indicated a mixed but principally diurnal tide. Tidal constituents moved through the Pass as nearly progressive waves. Asymmetry in the co-oscillating tidal motions was explained as a result of unequal frictional forces acting on flood and ebb currents in the Pass. Tidal excursions computed from the tidal harmonic constants and from cumulative net displacements suggested that tidal-period exchanges are not effective in flushing the bays even under tropic tidal conditions. Nontidal water levels were related to the cross-shelf component of the coastal wind stress at statistically significant levels. This suggested that low-frequency local meteorological forcing, as a set-up or set-down of coastal water levels, plays a valuable role in assisting tidally-driven exchanges. (Sims-ISWS)
W80-03027

A THREE-YEAR STUDY OF BENTHOS OF MUDDY ENVIRONMENTS IN PORT PHILLIP BAY, VICTORIA,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
G. C. B. Poore, and S. Rainer.
Estuarine and Coastal Marine Science, Vol 9, No 4, p 477-497, October 1979. 8 Fig, 6 Tab, 35 Ref.

Descriptors: *Bays, *Benthos, *Biological communities, *Aquatic environment, *Australia, On-site investigations, Sediments, Marine biology, Aquatic life, Seasonal, Variability, Analytical techniques, Statistical methods, Data collections, Benthic fauna, Crustaceans, Foreign research, Foreign countries, Water quality, Water temperature, Salinity, Phosphorus, Nitrogen, *Port Phillip Bay, Polychaetes.

Samples taken four times a year over three years (1973-1975) at three widely separate stations in muddy environments in Port Phillip Bay were used to compare species diversity and composition of the benthic community between areas, seasons, and years. Analysis of variance of five community statistics: the number of individuals, the number of species, Shannon's diversity, and two evenness measures, showed that differences among the three stations and among years contributed the largest fractions of the variance in number of individuals and species but little to diversity or evenness. Seasonal differences contributed negligibly to variance in any statistic except diversity. Small scale spatial patchiness (from replicate samples within stations) contributed a significant fraction of variance to all five statistics. The fauna at all stations was dominated by the deposit-feeding bivalve Theora fragilis and the decapod shrimp Callianassa limosa; only minor species were restricted to single stations. The density of few species varied seasonally, but several were more abundant in some years than others. Hierarchical classification using the Canberra metric dissimilarity coefficient grouped samples into station groups. Use of the Bray-Curtis coefficient grouped some samples by station and some by season, and it was concluded that the main differences between stations were in overall species composition, not in the densities of dominant species. Temporal changes in community structure were nonseasonal but were irregular changes occurring at single stations. Differences in

fauna between stations were related in part to small differences in sediment-type but not to physico-chemical features of the overlying water. The irregular fluctuations in density of the common species and in the identity of the minor species suggest that multiple-stable points in community structure may exist for the silty-clay community. The two major species seemed not to have altered each other's environment over the sampling period. Considerable variation in species composition may occur in soft-bottom benthos in the absence of marked environmental perturbations. (Humphreys-ISWS)
W80-03028

ZINC IN THE CONWY RIVER AND ESTUARY,
Leeds Univ. (England). Dept. of Earth Sciences.
H. Elderfield, A. Hepworth, P. N. Edwards, and L. M. Holliday.
Estuarine and Coastal Marine Science, Vol 9, No 4, p 403-422, October 1979. 10 Fig, 4 Tab, 45 Ref.

Descriptors: *Estuaries, *Water pollution sources, *Zinc, *Diagenesis, Sediments, Iron, Manganese, Pollutants, Heavy metals, On-site investigations, Rivers, Spatial distribution, Data collections, Analytical techniques, Connate water, Water quality, Solubility, Sulfides, Estuarine environment, Foreign research, Foreign countries, *Wales, *Conwy River(Wales).

The objective of this research was to identify the important inorganic reactions which control the behavior of zinc supplied to waters of the Conwy River and Estuary in North Wales, a region free of heavy urban and industrial pollution, but subject to the effects of mineralization; this included an examination of the diagenesis of zinc in anoxic estuarine sediment. Several factors were identified which contribute to the geochemical balance of zinc in the Conwy River and Estuary. (1) Precipitation of iron and manganese which are mobilized in acid, reducing soils acts to remove dissolved zinc from tributary streams and to promote a particulate flux in the river of zinc associated with hydrous iron and manganese oxides. (2) There is no large-scale removal of dissolved zinc during the mixing of river water and sea water in the estuary. (3) Zinc is precipitated with iron as an insoluble sulphide in anoxic estuarine sediments. (4) Because of diagenetic remobilization processes, the surface layer of estuarine sediments is enriched in iron and manganese, and, to a lesser extent, zinc. Resuspension of this layer may promote the formation of zinc-rich particles in bottom waters of the estuary. Further work is required in estuaries where two-end-member mixing can be demonstrated in order to provide more precise information as to whether removal of zinc and other heavy metals can occur through the flocculation of dissolved iron at low salinities. In addition, more comprehensive and mechanistically-oriented studies are urgently needed on the distribution of dissolved metals in pore waters of sulphide-rich sediments. (Humphreys-ISWS)
W80-03029

A VARIABLE-DEPTH GREEN'S FUNCTION FOR SHELF EDGE TIDES,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
C. Garrett, and B. Toulany.
Journal of Physical Oceanography, Vol 9, No 6, p 1258-1272, November 1979. 15 Fig, 1 Tab, 10 Ref.

Descriptors: *Tides, *Continental shelf, *Model studies, Mathematical models, Theoretical analysis, Oceans, Coasts, Gulfs, Equations, Mathematics, Oceanography, *Gulf of Maine, *Bay of Fundy.

The Green's function for a semi-infinite ocean with depth a function of distance from the boundary was developed numerically for the M sub 2 frequency and with Coriolis frequency and depth profile appropriate to the continental slope off the Gulf of Maine. This involved numerical integration of the linearized shallow water equations for all longshore wave numbers, followed by numerical Fourier transformation. This variable-depth Green's function is approximately equal to Buchwald's constant-depth Green's function for distances along the boundary greater than the width of the slope, and at very short range tends to limiting values which can be approximated analytically. The Green's function, when combined with currents from Greenberg's numerical model of the Bay of Fundy and Gulf of Maine, was used to explain substantial observed variations in M sub 2 amplitude and phase along the edge of the shelf off the Gulf of Maine; the variable-depth Green's function produced significantly better results than the constant-depth Green's function. The results supported the basic premise that the M sub 2 elevation at the shelf edge in the absence of the Gulf of Maine would be fairly constant, and suggested ways of deriving open boundary input for tidal models of coastal seas with a minimum of offshore gaging. (Sims-ISWS)
W80-03030

THEORETICAL AND EXPERIMENTAL STUDY OF WIND- AND WAVE-INDUCED DRIFT,
Shell Development Co., Houston, TX.
For primary bibliographic entry see Field 5B.
W80-03031

AN APPROACH FOR HYDRODYNAMIC MODELING OF MAINE'S ESTUARIES,
Maine Univ. at Orono. Dept. of Civil Engineering.
R. B. Fidler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139595, Price codes: A05 in paper copy, A01 in microfiche. MS thesis August 1979. 85 p, 23 Fig, 1 Tab, 27 Ref, OWRT A-047-ME(2).

Descriptors: *Maine, *Mathematical models, *Estuaries, *Water pollution, *Hydrodynamics, Computer models, Water circulation, Currents(Water), Hydraulics, Movement, Tides, Winds, Hydrologic aspects, Hydraulic models.

A hydrodynamic study of the Upper Penobscot Bay in Maine was conducted using a three dimensional finite difference model. Penobscot Bay is a major commercial, industrial, and fishing center for the state. Models for water and waste movement are needed due to the rapid industrial growth along Maine's coast and the subsequent water pollution problems. Maine currently has no site suitability classification system for its coastal area. The model used here, GAL (for Galerkin) was implemented on the University of Maine IBM 370 System and to supplement printed output, pictoral representations of calculations current velocities are provided. The numerical model is widely applicable and reasonably inexpensive. Several prior hydrographic studies of the Bay were used to provide model data. Five sets of data are needed for the model: (1) bathymetry, (2) tidal, (3) river flow, (4) wind, and (5) current characteristics data. The Navier-Stokes equations and the continuity equations are used to describe processes causing water motion. A summary of GAL's mathematical and numerical development is given. Thirteen simulations were run providing successful significant information. A comparison of model results and actual field data show some success of describing Bay hydrodynamics. (Seigler-IPA)
W80-03084

COMPUTER SIMULATION OF STORM SURGES AND RIVER FLOODING IN MOBILE BAY,
Alabama Univ., University. Dept. of Chemical Engineering.
G. C. April, and S. Hu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-138514, Price codes: A07 in paper copy, A01 in microfiche. Bureau of Engineering Research Report No 232-112, March 1979. 138 p, 36 Fig, 13 Tab, 26 Ref, 3 Append. OWRT A-061-ALA(2).

Descriptors: *Model studies, *Computer models, *Hurricanes, *Surges, *Flood forecasting, Alabama, Gulf of Mexico, Tides, Salinity, Saline water, Winds, Hydrodynamics, Bays, Estuaries, River basins, Mobile River, Mobile Bay.

A modified Reid-Bodine hydrodynamic-salinity model and an open coast water model were used on the University of Alabama Univac-1110 computer system to simulate the Mobile Bay, Alabama, system under severe storm surge and/or flooding conditions. Mobile Bay with an area of 1036 sq km is located east of the Mississippi River delta on the north-eastern shore of the Gulf of Mexico. It is the terminus of the Mobile River basin and is the fourth largest drainage area in the U.S. The Bay is 50 km long and from 13 to 38 km wide. Historically hurricanes have caused much destruction in the area with 55 hurricanes affecting Alabama from 1711 through 1972. Hurricanes cause both surges in the bay and river flooding. Data input and sources are described including river flooding input data and storm surge input data with conformal mapping and storm surge equations. Model calibration and verification are also described. The model is used to describe water behavior during river flood stage as a function of river discharge rate. Results show that during river flood stage, Bay water properties are dominated by fresh river water. However, during storm surge conditions large amounts of saline water enter the Bay. The model is used to calculate water elevation, velocity, and salinity as a storm approaches. Comparison of model results with field data show reasonable accuracy. (Seigler-IPA)
W80-03088

IMPACT OF DELTA OUTFLOW UPON SALINITY AND WATERFOWL IN THE SUISUN MARSH,
Bureau of Reclamation, Washington, DC.
M. C. Rumboltz.
November 1979. 206 p, 161 Fig, 14 Tab, 1 Append.

Descriptors: *Saline water, *Wildlife habitats, *Ducks(Wild), *Model studies, Bays, California, Estuarine environment, Brackish water, Waterfowl, Water birds, Green-winged teal, Mallard duck, Shoveler duck, American widgeon, Tidal waters, Suisun Marsh.

Historical salinity levels in the Suisun Marsh and freshwater outflow from the Sacramento-San Joaquin Delta were studied and a Delta outflow model and salinity equations were developed to test management alternatives and to predict future salinities. The Suisun Marsh, located in the San Francisco Bay Estuary, is a wintering area or home for 200 species of birds, 45 species of mammals, and 36 species of reptiles. Birds wintering in the Marsh include the pintail duck, the American wigeon, mallards, shovelers, and green-winged teals. The Marsh is brackish with salinity levels ranging from 50 micromhos to 27,600 micromhos with 4,700 to 18,000 micromhos suggested as optimum for promoting waterfowl food plants. Low salinity levels occur during winter and spring when Delta outflow is high with high salinity levels occurring in summer and fall when outflow is low. Salinity/outflow equations were developed and verified to predict mean monthly salinity. The equations were used to join Delta outflow to the Marsh salinity model. Results from the use of the model indicate that in February through May Delta outflow will not be sufficient to provide optimum salinity. Various management alternatives to maintain optimum salinity levels include tide gates, waste water reuse, freshwater release, and rerouting of sloughs. Although salinity levels may be improved in the future to produce more food for ducks, duck populations may not increase. Extensive data plots are included. (Seigler-IPA)
W80-03099

ATP AS A MEASURE OF LIVING PHYTOPLANKTON CARBON IN ESTUARIES,
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W80-03115

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SOLAR ENERGY COLLECTORS AND PLANTS OPERATED BY THEM,
N. Laing, I. Laing, and O. Laing.
U.S. Patent No 4,172,766, 20 p, 14 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1205, October 30, 1979.

Descriptors: *Patents, *Desalination, *Solar radiation, Water purification, Sea water, Energy conversion, Electric power production, Desalination equipment.

The object of the invention is to provide a solar collector which is designed to float on water or air and which comprises elastic elements not subject to bending stresses within the range of their application. Water surfaces offer favourable conditions for collectors intended to be spread over a flat surface. Collectors comprise several flexible layers of which the lowest is an insulating layer, the layer above it conducts a heat carrier and the top layer serves to prevent convection losses. These layers can be prefabricated in the form of elements of large surface area. They are assembled by joining a large number of identical elements into a complete floating platform which in turn, is surrounded by peripheral elements so designed as to make a radial prestretching of the solar collector elements possible. A preferred field of application is electricity generation. In this application, a fluid heat carrier is pumped through ducts in the heat carrier conducting layer. The head so extracted heats of a quantity of stored water in a foil container immersed in the water. The heat may serve for feeding a turbine. If sea water is evaporated then the condensate can be extracted as fresh water. However the plant may also be so designed that it is entirely deployed for sea water distillation. In this case, the heat of condensation is drawn on for repeated distillation in further stages. (Sinha - OEIS)
W80-03225

WATER PURIFICATION SYSTEM,
W. E. Sear.
U.S. Patent No. 4,172,767, 6 p, 4 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 987, NO 5, p 1205, October 30, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, Water purification, Sea water, Solar radiation, Condensation, Desalination equipment.

The concept of the invention involves the provision of a system comprising a tank into which sea water or impotable water normally flows or settles. The top of this tank is covered by a plastic cover which is able to accomodate and pass the heating rays of the sun. Thesun's rays passing through this plastic cover causes the water captured within the tank portion to vaporize. As a result, the water within the tank becomes vaporized within the upper portion of the cover and above the sea water in the form of moisture-laden air. This moisture-laden air is then conveyed by a blower arrangement into a pipe line of any suitable material. The water condensrs as it passes through the line from an area of one temperature to an area of another and lower temperature. A fluid pump is provided in the line to pump the pure water into a fresh water storage tank where it can be stored pending transportation to the source using the fresh water. The entire unit may be supported in a float arrangement where some parts are suspended above the sea level while others are anchored below the sea. (Sinha-OEIS)
W80-03264

3C. Use Of Water Of Impaired Quality

SEWAGE EFFLUENT AND LIQUID DIGESTED SLUDGE AS AIDS TO REVEGETATION OF STRIP MINE SPOIL AND ANTHRACITE COAL REFUSE BANKS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
L. T. Kardos, W. E. Sopper, B. R. Edgerton, and L. E. DiLissio.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 315-331, 1979. 14 Fig, 15 Tab, 18 Ref. OWRT B-047-PA(10), B-069-PA(6).

Descriptors: *Sewage effluents, *Sludge disposal, *Coal mine wastes, *Vegetation establishment, Revegetation, Legumes, Grasses, Trees, Leachate, Soil chemistry, Acidic soils, Strip mines, Spoil banks, Chemical analysis, Lysimeters.

Sewage effluent and liquid digested sludge were used as ameliorating agents for revegetation of bituminous strip mine spoil and anthracite refuse in Pennsylvania. Revegetation of such areas is hampered by excessive acidity with high levels of iron, aluminum, and manganese; plant nutrient deficiency; drought; and lethally high surface temperatures. Plants used for revegetation included eight grass species, eight legume species, and eight tree species. Experimental treatment boxes contained 25 tons of spoil or refuse over a 6 inch layer of quartz sand resting on Hublersburg silt loam. Three lysimeters were used in each box to sample percolate water. Effluent and/or liquid sludge were applied at weekly intervals in amounts ranging from 0 to 5 cm. Weekly samples of effluent, liquid sludge, and leachate were analyzed for pH, total acidity, sulfates, nitrate N, organic N, ammonium N, orthophosphate P, total P, potassium, calcium, magnesium, manganese, iron, copper, boron, aluminum, zinc, and sodium. Results show that sewage effluent and/or liquid digested sludge will detoxify both spoil and refuse and promote the establishment of a vegetative cover that will persist. Greater growth after establishment can be obtained by periodic effluent or sludge applications. None of the legumes were found to be as productive as the grasses, and tree seedling survival rates were improved by the treatments. (See also W80-03089) (Seigler-IPA)
W80-03093

3D. Conservation In Domestic and Municipal Use

WATER REQUIREMENTS FOR URBAN LAWNS,
Arizona Univ., Tucson. Dept. of Plant Science.
W. R. Kneebone, I. L. Pepper, R. E. Danielson, W. E. Hart, and L. O. Pochop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140080, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute Wyoming University, Laramie, Project Completion Report, September 1979. 217 p, 24 Fig, 67 Tab, 18 Ref, 9 App. OWRT B-035-WYO(6), 14-34-0001-7201.

Descriptors: *Water requirements, *Sprinkler irrigation, *Lawns, *Turf grasses, Lysimeters, Arizona, Colorado, Wyoming, *Urban lawns.

Water requirements and application rates of urban lawns were studied in a 3-state (Arizona, Colorado and Wyoming) area. The study measured the water use of Kentucky bluegrass in Colorado and Wyoming, and of different bermudagrass cultivars, zoysia, St. Augustine grass and tall fescue in Arizona. The overall objective of the study was to obtain measured data concerning water use of urban lawns. This was accomplished by: (1) determining water requirements by use of lysimeters, (2) monitoring actual water application rates by homeowners, and (3) testing common sprinklers to determine their distribution patterns. A wide range of conditions were represented by the project. As indicated, Arizona worked with warm-season grasses, while Colorado and Wyoming worked with bluegrass. This, plus the fact that the study sites represent a wide north-south segment of the region, should make the results widely applicable. To make the findings further applicable they were prepared in the form of lawn watering guidelines that can be used by water managers.
W80-03002

3F. Conservation In Agriculture

EFFICIENCY IN THE USE OF WATER FOR IRRIGATION: THE ROLE OF PRICES AND REGULATIONS,
United Nations Centre for Natural Resources, Energy and Transport, NY.
H. M. Neghassi, and J. A. Seagraves.
Natural Resources Forum, Vol 3, No 4, p 53-72, 1978. 1 Fig, 6 Tab, 19 Ref.

Descriptors: *Water distribution(Applied), *Water allocation(Policy), *Irrigation programs, *Pricing, *Regulation, *Irrigation efficiency, Water conservation, Water management(Applied), Mexico, Economics, Water rates, Economic efficiency, Administrative agencies, Water policy, Low flow, Irrigation districts, Irrigation practices, Irrigation water, Agriculture.

Although engineering and agronomic constraints usually define the degree of efficiency necessary for use of irrigation water in any setting, artificial pricing and governmental regulation can both support improvements in equitable and efficient water use for agriculture. Using examples and case studies, the paper discusses physical and economic irrigation efficiencies and their interrelationships; the role of pricing and regulations is emphasized and general guidelines are explored for use of fixed-rate and volumetric rate pricing structures. Factors considered include: (1) value and resource combinations which relate to physical and economic efficiency in water use; (2) factors affecting prices and regulations for irrigation waters; (3) factors affecting prices and regulations for irrigation water; (4) pricing of irrigation water and alternative systems of delivering it to farms; and (5) water laws and ownership. A case study of irrigation water pricing in Mexico demonstrates that charges based on water volume or the number of irrigation events makes farmers more careful in their use of water, thus contributing to application efficiency, whereas flat rate charges per hectare or per season give no incentive to conserve water. Institutional arrangements for managing water from irrigation canals are affected by the extent to which flow can be regulated by such means as a reservoir. Since volumetric measurements are costly, they are recommended only when the value of water is high enough and the flow can be regulated. When flows are uncertain shares of the water rather than specific volumes should be allocated to individual farms. (Harris-Wisconsin)
W80-03140

LINEAR MOVE IRRIGATION SYSTEM AND CONTROL THEREFOR,
Valmont Industries, Inc., Valley, NE. (Assignee).
T. M. Johnson.
U.S. Patent No 4,172,551, 15 p, 17 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1134, October 30, 1979.

Descriptors: *Patents, *Irrigation systems, *Control systems, Automatic control, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

A linear move irrigation system and control for use in irrigating large land areas includes a water conduit extending over a portion of the field supported on a series of support towers. The entire conduit is made to move down the field to be irrigated. A control system controls the movement of the irrigation system along a defined path and maintains the wheel tracks of the conduit support towers generally parallel to the path. The control system includes a sensor located somewhere along the water conduit for sensing when a point located forward of the conduit relative to its direction of

travel, is off the defined path. The movement of outwardly located towers near opposite ends of the conduit are automatically controlled in response to predetermined displacement of the point relative to the path. The towers are preferably located at opposite ends of the conduit, so as to maintain the point over the defined path, and further to maintain the wheel tracks of the conduit support towers generally parallel as the system moves over the field. The controlled towers near opposite ends of the conduit are normally driven when the point is on the path. (Sinha-OEIS)
W80-03196

SELF-PROPELLED LINEAR IRRIGATION SYSTEM,
N. S. Standal.
U.S. Patent No 4,172,556, 14 p, 16 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1136, October 30, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance, Self-propelled pneumatic systems.

A self-propelled linear irrigation system including an elongated line move having sprinkler outlets along its length, mobile supports spaced along the line move and a main tractor having a water pipe outlet engaging member and a fluid powered prime mover is disclosed. The propulsion system comprises a pneumatic system involving a main compressed air line and compressed air storage tank on the main tractor and each mobile support. The tractor of the irrigation system has automatic coupling members for coupling to the water supply and compressed air supply and automatically propels itself from one compressed air and water station to the next compressed air and water station along a main supply line. The main tractor has a main rigid central section having connecting members for connecting the tractor with the elongated line move and a first and second valve car, each having extensible propulsion members connecting each valve car to the main section. The tractor also has a drift correction system to maintain the tractor and line move traveling along a straight course, parallel to the main water supply line. (Sinha-OEIS)
W80-03197

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

URBAN STORMWATER CONTROL PACKAGE FOR AUTOMATED REAL-TIME SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, D. M. Morrow, and R. C. Lazaro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139785, Price codes: A11 in paper copy, A01 in microfiche. Completion Report, December 1978. 234 p, 47 Fig, 22 Tab, 12 Ref, 5 Append. OWRT-C-6174 (5218)(3).

Descriptors: *Urban runoff, *Automatic control, *Computer models, *Storm runoff, Storm drains, Interceptor sewers, Storm water, Urban drainage, Combined sewers, Storage requirements, Water pollution sources, Numerical analysis, California, Runoff forecasting, Timing.

A methodology is presented for automatic computer control of in-line sewer storage as a cost-effective means of limiting water pollution for storm and combined sewer overflows. The methodology called a Stormwater Control Package (SWCP) involves the application of realistic computer models for inflow forecasting, sewer routing, and operational storage control for real-time simulated environments. Controllable in-line storage uses adjustable weirs, valves, or gates in interceptors, laterals, or outfalls to create backwater that is stored to prevent an overflow of untreated stormwater. Because rapid response is needed to deal with the complex flow characteristics occurring during a storm, automated computer control is needed. Fully automated control requires three systems: intelligence, central processing, and regulators. SWCP uses an autoregressive transfer-function type forecasting model and can be used as a tool to design and test automatic control systems. SWCP's control algorithm is described with a unique method for integrating unsteady flow and optimal control. The control package is applied to San Francisco's Marina Branch of the North Shore Outfalls Consolidation Project to demonstrate SWCP's potential usefulness. Results are presented along with reactive and adaptive control policies with an analysis of performance of control strategies. (Seigler-IPA)
W80-03080

PUBLIC DRAINAGE ATLAS: BROWN COUNTY, MINNESOTA,
Mankato State Univ., MN. Dept. of Biology.
L. Dunsmore, R. W. Oelerich, and H. W. Quade.
Limnological Contribution No 10, June 1979. 57 p, 69 Fig, 36 Tab. OWRT A-040-MINN(4).

Descriptors: *Drainage, *Ditches, *Minnesota, *Mapping, Hydrology, Computer models, Watersheds(Basins), Land use, Agricultural engineering, Drainage engineering, Geomorphology, Distribution patterns, Hydrography, Terrain analysis, River basins, Drainage systems.

Drainage data maps and tables are presented for Brown County in south central Minnesota. The data are to be used for the development of a computer modeling system of drainage effects. Drainage system features include ditches and riversheds. The planned computer modeling will aid planning for lake restoration, new ditch construction, and water resources development. An inventory of all county ditches is provided including ditch number, location, year established, length, area drained, tributary to, and rivershed. For consistency and ease of comparison, the Minnesota Land Management Information System (MLMIS) format is used. This format is also consistent with the United States land survey system. The county is divided into 40 acre townships which are subdivided in 36 sections made of 16 fourth acre parcels. For each of the 20 townships, data for four MLMIS variables are presented: land use, water orientation, soil landscape, and geomorphic regions. General land survey maps and present surface hydrology maps are also presented for each township as well as for the whole county. An overall Brown County ditch map shows ditches by decade of establishment and type (open or tiled). (Seigler-IPA)
W80-03095

PUBLIC DRAINAGE ATLAS: NICOLLET COUNTY, MINNESOTA,
Mankato State Univ., MN. Dept. of Biology.
L. Dunsmore, and H. W. Quade.
Limnological Contribution No 8, June 1979. 61 p, 82 Fig, 30 Tab. OWRT A-040-MINN(5).

Descriptors: *Drainage, *Ditches, *Minnesota, *Mapping, Hydrology, Computer models, Watersheds(Basins), Land use, Agricultural engineering, Drainage engineering, Geomorphology, Distribution patterns, Hydrography, Terrain analysis, River basins, Drainage systems.

Tables and maps of drainage data are presented for Nicollet County located in south central Minnesota. Drainage data primarily consist of ditches and riversheds since ditches are of agricultural importance in the area. Data are being collected for the ultimate development of a computer modeling technique for drainage effects. The model will be used for planning involving new drainage ditches, lake restoration, and other water resources development. An inventory of all county ditches is presented including ditch number, location, year established, length, area drained, tributary to, and rivershed. Data are presented according to the Minnesota Land Management Information System (MLMIS) format because it is consistent with the United States land survey system and because much data were taken from MLMIS. The system divides the county into 40 acre townships which are subdivided into 36 sections made of 16 fourth acre parcels. Data are presented for each of the county's 22 townships including general survey maps, present surface hydrology maps, land use tables, water orientation tables, soil landscape tables, and geomorphic regions tables. An overall Nicollet County ditch map is also presented along with overall maps for land use, water orientation, soil landscape, and geomorphic regions. (Seigler-IPA)
W80-03096

PUBLIC DRAINAGE ATLAS: LESUEUR COUNTY, MINNESOTA,
Mankato State Univ., MN. Dept. of Biology.
L. Dunsmore, and H. W. Quade.
Limnological Contribution No 7, May 1979. 51 p, 59 Fig, 33 Tab. OWRT A-040-MINN(3).

Descriptors: *Drainage, *Ditches, *Minnesota, *Mapping, Hydrology, Computer models, Watersheds(Basins), Land use, Agricultural engineering, Drainage engineering, Geomorphology, Distribution patterns, Hydrography, Terrain analysis, River basins, Drainage systems.

Drainage data are presented in the form of maps and tables for LeSueur County in south central Minnesota. Data are being collected for the ultimate development of computer modeling of drainage effects. Due to agricultural needs, drainage in the county is mostly in the form of ditches. The planned computer modeling will aid in planning for water resources development, lake restoration, and proposed new drainage ditches. An inventory of all county ditches is presented including ditch number, location, year established, length, area drained, tributary to, and rivershed. The Minnesota Land Management Information System (MLMIS) format is used because it is consistent with the United States land survey system and because much data were obtained from the system. The county is divided into townships each subdivided into 36 sections made of 16 fourth acre parcels. General land survey maps and present surface hydrology maps are presented for each of the county's 17 townships. Also provided are data on land use, water orientation, soil landscape, and geomorphic regions. Drainage data are also provided by rivershed. (Seigler-IPA)
W80-03097

ASSESSING IMPACTS OF LAND MANAGEMENT ACTIVITIES ON EROSION-RELATED NONPOINT SOURCE PROBLEMS,
Oregon State Dept. of Environmental Quality, Portland.
For primary bibliographic entry see Field 5B.
W80-03113

THE EFFECTS OF THE FOOD PREFERENCES AND STOCKING RATES OF GRASS CARP (CTENOPHARYNGODON IDELLA VAL.) ON MIXED PLANT COMMUNITIES,
Agricultural Research Council, Kidlington (England). Weed Research Organization.
M. C. Fowler, and T. O. Robson.
Aquatic Botany, Vol 5, No 3, p 261-276, 1978. 5 Fig, 5 Tab, 22 Ref.

Descriptors: *Aquatic weed control, *Grass carp, *Biocontrol, *Food habits, Algal control, Chara, Potamogeton pectinatus, Fish behavior, Predation, Fish stocking, Forage palatability, Elodea canadensis, Myriophyllum spicatum L., Potamogeton natans L., Ecology, Prey fish, Algae, Aquatic weeds, Browse utilization, England.

Results of two years of studies of the effect of grass carp grazing preferences in a mixed-plant aquatic weed community are reported. In a series of pond experiments conducted in Great Britain to replicate similar studies in other countries, small (10-30 g) grass carp (Ctenopharyngodon idella Val.) selectively grazed submerged weeds. In all the experiments, the carp ate their favorite species

first, i.e. Charasp., Potamogeton pectinatus and Elodea canadensis, and ignored the less-palatable Myriophyllum spicatum L. and P. natans L. Originally the total plant biomass was reduced as the palatable plants were grazed; however, the avoided species spread and eventually total biomass was similar to that in ungrazed pools. Some of the heavily grazed plants (P. pectinatus and Chara sp.) re-established themselves when the fish were removed. Only after a prolonged period without food did the fish begin grazing unpalatable plants. Similar results were obtained in ponds with bigger fish (200-400 g). These feeding behavioral experiments were showing that total plant biomass is quickly reduced after the introduction of fish for aquatic weed control purposes, especially at higher stocking rates; but these results are brought about only by the fish quickly eating the more-pallatable plants. For weed control purposes, the proportion of palatable to unpalatable plants in a weed community will determine the stocking rate needed to show rapid control of weeds. Generally, understocking should be avoided unless other measures are added to control the less-palatable plants. (Harris-Wisconsin)
W80-03121

HYDROLOGIC CONSIDERATIONS IN DECISION ANALYSES FOR RECLAIMING STRIP MINE LAND IN THE SOUTHWEST,
Arizona Univ., Tucson. Dept. of Watershed Management.
J. Thames, and T. Verma.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140130, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Project Completion Report, January 1980, 13 p, 2 Fig, 19 Ref. OWRT B-055-ARIZ(3), 14-34-0001-7139.

Descriptors: *Land reclamation, *Strip mines, *Land management, *Erosion control, Surface runoff, Flow control, Water pollution control, Planning, Surface mining control.

A multiattribute utility function is used to model preferences on outcomes of alternative reclamation schemes for stripmined lands, using Arizona and Wyoming examples. Each scheme should at least help restore land to its premining value, and is composed of three sets of actions: mining operations, preparations for postmining land use, and mitigating actions. Grazing and runoff augmentation are examples of postmining land use goals, and mitigating actions may be measures to protect the environment like pollution control in runoff or infiltration. Conflicting objectives are involved, including the maintenance of sufficient coal production, the alleviation of detrimental environmental effects, and the minimization of loss. Since the environmental effects are fraught with uncertainty, a multiobjective decision-making scheme under uncertainty is set up to analyze the problem. The decision model ranks alternative reclamation schemes on the basis of the preference function of a group decision maker, each member of which assessing a separate subset of single attribute utility functions.
W80-03176

SOIL SEDIMENT DEPOSITS IN SUBSURFACE DRAINS,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
L. B. Grass, L. S. Willardson, and R. A. LeMert.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1054-1057, September-October 1979. 6 Fig, 2 Tab, 17 Ref.

Descriptors: *Tile drains, *Subsurface drains, *Sediments, *Clogging, *California, Deposition(Sediments), Drains, Drainage, Drainage practices, Tiles, Soils, Soil water, Irrigation, Salinity, On-site investigations, Agriculture.

The possible mode of sediment entry into drains may be determined by comparing the particle-size distribution curves of the deposits with those of corresponding soils. Some deposits will be finer, some similar, and some coarser in texture than the soil. Variations in texture are due to a sorting process effected by the envelope, by reductions in water-flow velocity, by breaks or loose joints in the drain pipe, or by the effluents washing the fine sediments out of the drain. The dispersive effect of a high sodium content can also influence the texture of the deposit. (Sims-ISWS)
W80-03178

A MODEL FOR EVALUATING RUNOFF-QUALITY IN METROPOLITAN MASTER PLANNING,
Water Resources Engineers Inc., Walnut Creek, CA.
For primary bibliographic entry see Field 5B.
W80-03199

DESIGN OF FLOOD CONTROL IMPROVEMENTS BY SYSTEMS ANALYSIS: A CASE STUDY,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W80-03203

4B. Groundwater Management

CONNECTOR WELLS, A MECHANISM FOR WATER MANAGEMENT IN THE CENTRAL FLORIDA PHOSPHATE DISTRICT,
LaMoreaux (P. E.) and Associates, Inc., Tuscaloosa, AL.
P. E. LaMoreaux.
Journal of Hydrology, Vol 43, No 1/4, p 469-490, October 1979. 8 Fig, 4 Tab, 24 Ref.

Descriptors: *Recharge wells, *Florida, *Water management(Applied), *Siphons, *Groundwater recharge, Injection wells, Potentiometric level, Water table aquifers, Aquifer testing, Hydraulic properties, Pumping, Water wells, Aquifers, Phosphates, Percolation, *Floridan aquifer, Connector wells, Siphon wells, Gravity flow.

Connector wells, a mechanism for water management in the Central Florida Phosphate District, have proven to be an effective means of moving good quality groundwater from one formation downward to another under gravity flow; there results beneficial recharge to the underlying Floridan Aquifer and a solution to a dewatering problem that enhances the mining of the phosphate ore. Three unique recharge systems have been developed in the phosphate district of Florida that include recharge through connector wells by gravity flow of water from the overburden sand aquifer to the Floridan Aquifer, a system of siphon wells recharging water from the overburden to the underlying Floridan Aquifer by connector wells. The siphon well recharging system has also been used effectively to relieve head or hydrostatic pressures built up in dams and dikes. (Visocky-ISWS)
W80-03041

PROBLEMS OF LARGE-SCALE GROUNDWATER DEVELOPMENT,
Hebrew Univ., Jerusalem (Israel). Center for Groundwater Research.
S. Mandel.
Journal of Hydrology, Vol 43, No 1/4, p 439-443, October 1979. 3 Ref.

Descriptors: *Groundwater, *Water resources, *Planning, *Water management(Applied), Water resources development, Water supply development, Wells, Water wells, Technology, Social aspects, Legal aspects, Water supply, Groundwater mining, Technical factors.

The difficulties encountered in the planned development of groundwater resources were analyzed by comparing typical 'scripts' for surface and groundwater resources, respectively. The suggested remedies were: (1) campaigns of systematic field investigations in any area where the intensive exploitation of groundwater is envisaged; (2) standardization and codification of modern research techniques so that they can more readily be used by any investigator; (3) the construction of water supply networks serving more than one user in order to stimulate cooperation and mutual control among water users and to facilitate the centralized regulation of groundwater abstraction. (Sims-ISWS)
W80-03043

WATER BUDGET AND HYDRAULIC ASPECTS OF ARTIFICIAL RECHARGE, SOUTH COAST OF PUERTO RICO,
Geological Survey, Fort Buchanan, PR. Water Resources Div.
J. E. Heisel, and J. R. Gonzales.
Geological Survey Water-Resources Investigations 78-58, May 1979. 102 p, 44 Fig, 17 Tab, 12 Ref.

Descriptors: *Aquifer management, *Groundwater recharge, *Model studies, *Artificial recharge, *Puerto Rico, Injection wells, Irrigation water, Infiltration, Water levels, Water quality, Evaluation, Analog models, *South-coastal Puerto Rico.

An analog model was used to evaluate groundwater conditions on the south coast of Puerto Rico. Water levels during a normal period and during an extended drought were simulated. Recharge and discharge values are reported. The model was also used to evaluate the possibilities of using treated waste water to recharge the aquifer. Three methods were considered: infiltration basins, injection, and irrigation. The tests were planned to determine what changes in water levels would result if certain rates of application were used. Because of the limited vertical hydraulic conductivity, irrigation is suggested as the most practical method of waste-water use. (Woodard-USGS)
W80-03160

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF GRAZING ON RUNOFF AND SEDIMENT YIELD FROM DESERT RANGELAND AT BADGER WASH IN WESTERN COLORADO, 1953-73,
Geological Survey, Lakewood, CO. Water Resources Div.
G. C. Lusby.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.50. Geological Survey Water-Supply Paper 1532-I, 1979. 134 p, 10 Fig, 1 Plate, 11 Tab, 9 Ref.

Descriptors: *Grazing, *Effects, *Runoff, *Sediment yield, *Range management, Evaluation, Sheet erosion, Storm runoff, Rainfall-runoff relationships, Soil types, Arid lands, Colorado, Utah, *Badger Wash(CO), Desert rangeland, Cattle grazing, Sheep grazing, Grazing rotation.

Four different systems of livestock management were compared hydrologically during a 20-year study (1953-73) in western Colorado. These systems were (1) grazing by cattle and sheep from November 15 to May 15 each year, (2) complete elimination of grazing, (3) grazing by sheep from November 15 to February 15 each year, and (4) grazing by sheep from November 15 to February 15 every other year. Grazing by both cattle and sheep from November 15 to May 15 each year was the standard grazing practice in the area at the beginning of the study. Complete grazing exclusion resulted in a reduction in runoff of about 20 percent during the period 1953-65 and an additional 20 percent during 1966-73. During the same periods sediment yield was reduced by 35 and 28 percent, respectively, for a total of 63 percent. A change in grazing use from cattle and sheep, November 15 - May 15 each year, to sheep only at approximately the same utilization rate, November 15 - February 15 each year, was accompanied by a reduction in runoff and sediment yield of about 29 percent. The same change in use, except for grazing allowed every other year during the sheep grazing period, resulted in a reduction in runoff and sediment yield of about 20 percent. (Woodard-USGS)
W80-03166

A MODEL FOR EVALUATING RUNOFF-QUALITY IN METROPOLITAN MASTER PLANNING,
Water Resources Engineers Inc., Walnut Creek, CA.
For primary bibliographic entry see Field 5B.
W80-03199

4D. Watershed Protection

WILLAMETTE RIVER SEDIMENT MANAGEMENT POSSIBILITIES: PHASE I -- PROBLEM CLARIFICATION,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 2J.
W80-03008

EFFECTS OF STEM DENSITY UPON SEDIMENT RETENTION BY SALT MARSH CORDGRASS, SPARTINA ALTERNIFLORA LOISEL,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
M. L. Gleason, D. A. Elmer, N. C. Pien, and J. S. Fisher.
Estuaries, Vol 2, No 4, p 271-273, December 1979. 4 Fig, 6 Ref.

Descriptors: *Sediments, *Sands, *Grasses, *Beaches, Waves(Water), Vegetation, Vegetation establishment, Deposition(Sediments), Coasts, Shores, Slopes, Erosion, Erosion control, Laboratory tests, Salt marsh cordgrass.

A laboratory experiment was conducted to determine whether retention of waterborne sand by salt marsh cordgrass, Spartina alterniflora Loisel, is directly related to the number of stems per unit area. Waves generated in a trough washed over a sloping beach planted with S. alterniflora springs; a range of stem densities (0-108 stems/sq m) was examined in separate trials. The amount of sand accumulated after 60 waves was a positive nonlinear function of stem density. The greatest accretion coincided with the highest stem density tested. Shape of the beach profile was also strongly influenced by the number of stems per sq m. (Sims-ISWS)
W80-03026

PREVENTION OF LONG-TERM ECOLOGICAL DAMAGE IN A DROUGHT,
Botswana Ministry of Agriculture, Gaborone. Div. of Land Utilization.
F. S. Alidi.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 261-268, 1979. 1 Tab, 3 Fig.

Descriptors: *Droughts, *Water management(Applied), *Accelerated erosion, *Weather data, Carrying capacity, Runoff, Grazing, Natural resources, Livestock, Burning, Wind erosion, Soil erosion, Botswana.

Several means by which long-term ecological damage by drought in Botswana can be minimized are discussed: (1) training and education of agriculturists and meteorologists, particularly with regard to water use, (2) establishment of weather stations to supply the country with weather reports and data to help in the development of water sources for agriculture and industry, (3) dissemination of a better understanding of the causes and effects of overgrazing, veld fires, devegetation, lack of soil cover, lack of protection against wind and rainfall erosion - at the local level particularly, (4) stabilization of areas against further desert encroachment by planting harider species and by avoiding overexploitation of that area, (5) reduction of wildlife and livestock populations to correlate with carrying capacity, and (6) improved farming methods for crop production. The effect of devegetation on local water balance is most significant when bare soil is less able to capture and absorb what rain does fall, and runoff accelerates while underground water and springs are deprived of recharge. For these reasons this author is convinced that overgrazing and over-exploitation of Botswana's natural resources, rather than actual rainfall deficiency, are the main causes of drought. (Tickes-Arizona)
W80-03076

AN IMPROVED SEDIMENT DELIVERY MODEL FOR PIEDMONT FORESTS,
Georgia Univ., Athens. School of Forest Resources.
R. G. Burns.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139801, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta. Technical Completion Report No ERC 03-79, June 1979. 80 p, 6 Fig, 12 Tab, 26 Ref, 1 Append. OWRT A-053-GA(1).

Descriptors: *Sediment control, *Forest management, *Model studies, Georgia, Sediment transport, Erosion control, Watershed management, Soil stability, Soil moisture, Pine trees, Runoff, Rainfall, Lumber, Clear-cutting, Forest soils, Lumbering.

Two similar watersheds in the pine production area of the central Georgia piedmont were studied to develop an improved sediment delivery model for use as a management tool for forest harvesting and site preparation. Eight watershed segments were instrumented in the treated basin and four in the untreated control basin. The treated basin was commercially clearcut then prepared in two stages with drum roller choppers. Thirty-one sets of data were collected for rainfall, runoff, and fine sediment delivery. Other data collected include the occurrence, location, and condition of all bare soil in each area during each phase of harvesting and site preparation. the model, based in part on the 'universal soil loss equation' has three components: energy, site, and erosion hazard. Tested as indices of the energy component were the rainfall erosivity factor R, gross precipitation Pg, and the product of runoff volume and peak discharge rate Qvp. Soil erodibility K, watershed segment slope S, average sediment topographic slope length L, and gully density G were tested as site component indices. For the erosion hazard component total bare soil B, a new erosion hazard index W, and its approximation Wa were used. Several model combinations were tested and all were superior to previous models. Use of the W hazard index indicates that minimal bare soil and maximum distance to stream channels are important management concerns for forest harvest practices. (Seigler-IPA)
W80-03081

HYDROLOGIC CONSIDERATIONS IN DECISION ANALYSES FOR RECLAIMING STRIP MINE LAND IN THE SOUTHWEST,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 4A.
W80-03176

FILTRATION OF SEDIMENT BY SIMULATED VEGETATION II. UNSTEADY FLOW WITH NON-HOMOGENEOUS SEDIMENT,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. C. Hayes, B. J. Barfield, and R. I. Barnhisel.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1063-1067, September-October 1979. 6 Fig, 2 Tab, 12 Ref.

Descriptors: *Sediment control, *Grasses, *Model studies, Mathematical models, Vegetation, Vegetation effects, Construction, Mining, Strip mines, Filters, Filtration, Deposition(Sediments), Sedimentation, Sedimentology, Grass sediment filters.

Reduction of sediment yield from disturbed areas such as strip mines and construction sites has continued to be a problem. Vegetal filtration has previously been recommended as a means of reducing the quantity of sediment which reaches the streams and rivers. Recent successful studies using uniformly sized particles in simulated erect vegetation have led to a series of equations which have been proposed to define the deposition within a grass filter. These equations utilized a spacing hydraulic radius to define the characteristic length applicable to the calculation of a Reynold's number. Prediction of mean velocity and channel bottom drag force were determined using this Reynold's number. These relationships were then used in conjunction with Einstein's sediment transport parameters for determination of total load transport in an artificial media. Barfield and others presented a model for making these predictions for steady flow conditions. These equations have now been extended to a continuity model for the prediction of the sediment profile with nonuniform particle sizes and time-varying inflows. In addition, some example calculations were shown in this report which demonstrate the sensitivity of the model to changes in various parameters under unsteady flow conditions. (See also W79-10252) (Sims-ISWS)
W80-03177

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

METHODS FOR THE ASSESSMENT OF AQUEOUS ORGANIC MATERIALS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
D. W. Schnare, R. F. Christman, and F. K. Pfaender.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140049, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina, Raleigh, Rpt No 145, August 1979. 90 p, 4 Fig, 15 Tab. OWRT A-087-NC(1), 14-34-0001-7070.

Descriptors: *Organic pollutants, Organic compounds, XAD resins, Solute polarity, Flow rates, Elution solvent, Contaminants in water, Non-volatile organics, Hydrogen ion concentration, Resins, Water analysis, Analytical techniques.

XAD resins have been evaluated with a range of known organic compounds for possible use in a fractionation method intended to comprehensively analyze the organic contaminants present in water. Among the parameters investigated are the effects on the extraction efficiency of solute polarity, flow rate, pH, elution solvent, and the container in which the extraction and elution are carried out. These studies provide a basis for a suggested procedure using XAD resins that can be rapid and efficient for isolating a wide range of non-volatile contaminants from water. Using this method, high recoveries allow isolation and recovery of organics initially present in sub part per billion concentrations. Furthermore, water samples can be extracted in the field. Extraction of water and elution of the resin can take place in a single vessel, which eliminates many handling and concentration problems attendant with carbon adsorption methods. The batch desorption characteristic allows for greater recoveries, and spiking of the desorption solvent can provide an internal standard which aids accurate and reproducible quantitation, two significant improvements over other suggested resin methods. This method provides a solution of non-volatile organics in concentrations necessary for GLC or GC/MS identification and quantitation. (Kiger-NC)
W80-03006

A RESONANCE RAMAN METHOD FOR THE RAPID DETECTION, IDENTIFICATION AND QUANTITATION OF BACTERIA IN SEWAGE AND NATURAL WATERS,
Rhode Island Univ., Kingston. Dept. of Chemistry.
W. H. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-138522, Price codes: A02 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island, Completion Report, 1979. 18 p, 4 Fig, 3 Tab, 24 Ref. OWRT B-078-RI(1).

Descriptors: *Spectroscopy, *Sewage bacteria, *Aquatic microorganisms, *Chemical analysis, Spectrometers, Fluorescence, Sanitary engineering, Water pollution sources, Pathogenic bacteria, Resonance, Coliforms, Water quality, Resonance Raman.

Resonance Raman spectroscopy was used to rapidly identify and quantify chromogenic bacteria in water. A rapid and reliable method such as this would be a valuable tool for testing for bacterial contamination in public water supplies as the currently used coliform standards are time consuming and in many cases nonspecific. A series of carotene-containing bacteria were studied including Agmanellum quadruplicatum, Coccochloris elabens, and Rhodopseudomonas palastris. A standard Spex Model 1401 spectrometer with a photon counting detection system was used with incident light at 514.5 and 488.0 nm supplied by a Model CR-2 argon ion laser. Line intensities and energies are presented. Two intense bands were found for specific, interpretable resonance Raman spectra. The spectra were simply obtained, of high quality, and are reproducible. The method will allow for the rapid identification of microorganisms in the presence of 'contaminants' such as sewage and water. (Seigler-IPA)
W80-03087

ENHANCEMENT OF LUMINOL CHEMILUMINESCENCE WITH HALIDE IONS,
Maine Univ. at Orono. Dept. of Chemistry.
D. E. Bause, and H. H. Patterson.
Analytical Chemistry, Vol 51, No 13, p 2288-2289, November 1979. 2 Tab, 6 Ref. OWRT B-016-ME(1).

Descriptors: *Bromides, *Chemical analysis, *Spectrophotometry, *Water analysis, Fuorescence, Chromium, Chlorides, Halides, Freshwater, Saline water, Fluorometry, Sea water, Water chemistry, Anions.

Improvements in the use of chemiluminescence analysis to detect trace Cr(III) in marine and freshwater environments are reported. This analysis is based upon the oxidation of luminol by hydrogen peroxide in basic aqueous solutions with Cr(III) as the catalyst. Several ions, C1(-), F(-), and SO4(2-) have been found to enhance chemiluminescence intensity, however, for the bromide ion intensity increase is eightfold and is proportional to Cr(III) concentration. Although the mechanism of this bromide enhancement is not clear it appears to be an ion-pairing phenomenom. Enhancement data were obtained using a flow system with two 20-ml plastic syringes. One syringe contained the Cr(III) sample and the other contained a solution of luminol and hydrogen peroxide. The solutins were mixed prior to entering a Perkin-Elmer MPF-44A Fluorescences Spectrophotometer for measurement of signal responses. With the use of bromide ion enhancement the detection limit for Cr(III) has been significantly lowered to 1.3 X 10 to the minus 10th power M and the enhancement is applicable to both fresh and marine water analysis. (Seigler-IPA)
W80-03094

SALMONELLA SP. HARBORED BY AQUATIC FAUNA AS INDICES OF FECAL POLLUTION,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
E. V. Morse, K. A. Gossett, and R. L. Lawton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140064, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 127, January 1980. 59 p, 5 Fig, 22 Tab, 36 Ref, 1 Append. OWRT B-076-IND(5).

Descriptors: *Salmonella, *Water pollution source, *Indicator bacteria, Aerobic bacteria, Fish, Aquatic life, Bioindicators, Water quality, *Indices, Fecal pollution.

The presence of the bacteria Salmonella in the aquatic environment indicates fecal pollution. This study identifies salmonella as a useful and reliable index of contamination of bodies of water used for drinking, bathing, fishing, or aquatic recreational activities. Techniques for collecting water samples were developed. Eleven serotypes were found among 131 salmonella isolates when Wabash River (IND) native fish and fresh water mussels were cultured. Salmonellae were found capable of colonizing the intestinal tract of native fishes. Higher concentrations of salmonellae were found in fish intestinal tracts than were present in environmental water. Several serotypes were present in the fish which were not present in their habitat water. Increased eutrophy of the water decreased infection rates. However when bottom sediment was allowed to 'build up' increased infection rates were evident. Physiological stress increased piscine salmonella infection rates. It is concluded that Salmonella may be used as monitors of fecal pollution in the aquatic biosphere. The bacteria when present in native fishes, may be retrospective indices of fecal pollution. The presence of Salmonella in any body of water raises serious questions as to its safety, i.e. drinking and total body immersion, both for man and livestock. (Wiersma-Purdue)
W80-03173

BIOCHEMICAL SIGNIFICANCE OF ARSENICAL POLLUTANTS IN A POTABLE WATER SUPPLY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
S. D. Faust, and W. H. Clement.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140031, Price codes: A02, in paper copy, A01 in microfiche. Final Technical Completion Report, Water Resources Research Institute, Rutgers University, January 1980. 18 p, 3 Fig, 7 Tab, 22 Ref. OWRT A-051-NJ(1), 14-34-0001-8032.

Descriptors: *Arsenic compounds, Aerobic conditions, Anaerobic conditions, Mud, Pollutant identification, Toxins, Contaminants, Contaminant release, Simulated reservoirs.

The essential results of this study are that greater percentages of arsenic were released from contaminated muds under anaerobic conditions (in the water phase) and at slightly faster rates than under aerobic conditions. In one of the experiments, exposure to sunlight appeared to catalyze the arsenic release under both aerobic and anaerobic conditions. The aerobic release of arsenic is an atypical condition. Greater releases of arsenic are typically from anaerobic conditions. Concurrent experiments on iron release from contaminated muds showed greater percentages of Fe2+ were released under anaerobic than under aerobic conditions. No firm conclusions were drawn. There are, however, strong indications that anaerobic conditions may yield greater quantities of arsenic compounds in the reduced valence state (+III) than aerobic conditions where the (+V) valence state would predominate. That the anaerobic chemistry of arsenic release may be linked to iron is suggested. The release of ferrous phosphate compounds from anaerobic lake sediments to overlying waters is documented quite well in the literature. Since the chemistries of arsenic and phosphate are similar, dissolution of ferrous arsenite compounds may account for both iron and arsenic release.
W80-03175

TILLAGE SYSTEM EFFECTS ON SEDIMENT AND NUTRIENTS IN RUNOFF FROM SMALL WATERSHEDS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03183

NUTRIENT LOADS IN STREAMFLOW FROM SANDY SOILS IN FLORIDA,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03184

RELATIONSHIPS BETWEEN STREAM DISCHARGE AND YIELD OF DISSOLVED SUBSTANCES FROM A COLORADO MOUNTAIN WATERSHED,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 5B.
W80-03191

EFFECTS OF ABRUPT CHANGE IN WATER QUALITY ON RAINBOW TROUT (SALMO GAIRDNERI RICH.),
Genoa Univ. (Italy). Inst. of Zoology.
A. Arillo, L. Lamba Doria, C. Margiocco, F. Melodia, and P. Mensi.
Memorie dell'Istituto Italiano di Idrobiologia, Vol 36, p 91-108, 1978. 4 Fig, 3 Tab, 55 Ref.

Descriptors: *Rainbow trout, *Biochemistry, *Water quality, Amino acids, Proteins, Water chemistry, Trophic level, Fish physiology, Animal metabolism, Chemical analysis, *Tissue analysis.

300 specimens of Salmo gairdneri, acclimated to running water from Lake Maggiore, were introduced, after one or two day starvation into experimental tanks containing water from Monate, Mergozzo, Maggiore (controls), Comabbio and Varese lakes, which present increasing trophic levels. By the end of the experiment (4 hr) the concentrations of several compounds (e.g. aminoacids, glycogen, glucose, lactate, malate and cyclic AMP) in the liver were assayed, along with the hemoglobin content of the skin mucus. Only alanine and glycogen levels departed from those reported in the literature for Salmo gairdneri. (Deal-EIS)
W80-03210

EUTROPHICATION, MINUTE ALGAE AND INEFFICIENT GRAZERS,
Oslo Univ. (Norway). Inst. of Zoology.
For primary bibliographic entry see Field 5B.
W80-03211

A STUDY OF THE DISTRIBUTION OF MERCURY IN THE VARIOUS COMPARTMENTS OF THE NORTH SEA AND SCHELDT ESTUARY ECOSYSTEMS,
Beheerseenheid Model Noordzee en Schelde Brussel, (Belgium).
W. Baeyens, G. Decadt, and I. Elskens.
Oceanologica Acta, Vol 2, No 4, p 447-457, 1979. 11 Fig, 7 Tab, 32 Ref.

Descriptors: *Mercury, *Path of pollutants, *Thermodynamic behavior, Ecosystems, Estuaries, Phytoplankton, Zooplankton, Bottom sediments, Physicochemical properties, Chemical reactions, Water chemistry, Heavy metals, *North Sea, *Tissue analysis, *Methylmercury, Scheldt Estuary.

The distribution of mercury in various compartments of the North Sea and Scheldt ecosystems was investigated. The experimental results showed that: (1) in the North Sea, the ratio of particulate to dissolved mercury in the water column was close to 1:1, while in the estuary (particularly in its upper portion) this ratio was much higher; (2) the mercury content of living organisms was higher in phyto- and zoo-plankton than in fish, although detrital matter still contained about five times more mercury than phytoplankton; and (3) the concentration of mercury in marine sediments was situated between those found in zooplankton and fish. Thermodynamic stability diagrams for aqueous and solid mercury compounds in seawater and brackish water provided valuable information for the interpretation of the observed mercury distribution. Under reducing conditions, mercury-sulphide compounds were predominant, in both water systems. These compounds play a very important role in the accumulation and release of mercury in sediments (the stable solid compound under reducing conditions, cinnabar, determines the mobility of mercury in the interstitial water), and in living organisms (the latter produce metallothioneins, which contain a large number of -SH groups and show high affinities for mercury). In combination with electrostatic forces these compounds probably also play a role in the process of adsorption of Hg C13-, which is theoretically the predominant

mercury compound in the North Sea and the major part of the Scheldt estuary, on suspended matter. (Deal-EIS)
W80-03213

TOXICITY TESTING IN THE UNITED KINGDOM FOR THE EVALUATION OF OIL SLICK DISPERSANTS,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
M. G. Norton, F. L. Franklin, and R. A. A. Blackman.
In: Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L. T. McCarthy, Jr., G. P. Lindblom and H. F. Walter, Eds., American Society for Testing and Materials, p 18-34, 1978. 4 Fig, 6 Tab, 9 Ref.

Descriptors: *Toxicity, *Bioassay, *Methodology, Testing procedures, Analytical techniques, Oil spills, Oil, Organic compounds, Water pollution control, Shrimp, Mortality, *Dispersants, *Oil dispersants.

Until recently, the toxicity of dispersants approved for use in U.K. waters was evaluated by a static bioassay on the dispersant alone. Following the 1974 Dumping at Sea Act, dispersant evaluation methods were reviewed and dispersants are now licensed for sea (offshore) or for beach use, based on two tests to assess the environmental effect of the dispersant use. The 'sea' test assesses the toxicity to Crangon crangon of a chemically dispersed oil and compares it with the toxicity of the oil alone. Mortality is measured over a period of 100 min at an oil concentration of 1000 ppm. The 'beach' test assesses the toxicity of the dispersant alone to a typical intertidal organism, Patella vulgata, by spraying with dispersant and rinsing in a simulated tidal cycle. Mortalities are measured after 72 h and compared with those of an oil control. The rationale behind the development of these tests is described, together with the experimental results. The U.K. criteria for licensing products on the basis of these test results are also discussed. (Deal-EIS)
W80-03214

ACUTE AQUATIC TOXICITY AND DISPERSING EFFECTIVENESS OF OIL SPILL DISPERSANTS: RESULTS OF A CANADIAN OIL DISPERSANT TESTING PROGRAM (1973 TO 1977),
Environmental Protection Service, Halifax (Nova Scotia).
K. G. Doe, and P. G. Wells.
In: Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L. T. McCarthy, Jr., C. P. Lindblom and H. F. Walter, Eds., American Society for Testing and Materials, p 50-65, 1978. 5 Tab, 56 Ref.

Descriptors: *Oil spills, *Toxicity, *Bioassay, Oil, Organic compounds, Rainbow trout, Killifishes, Lobsters, Water pollution control, Water quality standards, Surfactants, Lobsters, *Dispersants, *Oil dispersants, *Crude oil.

An oil spill dispersant testing program was initiated in 1973 to evaluate the toxicity and dispersing effectiveness of dispersants submitted to Fisheries and Environment Canada for approval prior to use in Canadian waters. Screening toxicity tests with rainbow trout (Salmo gairdneri) were performed initially on 19 dispersants. Thirteen were considered sufficiently nonacutely toxic to justify further evaluation using methods and criteria of the Canadian Guidelines on the use and acceptability of oil spill dispersants. The dispersants BP1100X, Corexit 8666, Drew Chemical OSE 71, Drew Chemical OSE 72, Oilsperse 43, and Sugee 2 passed both the toxicity and effectiveness criteria and were placed on the Canadian standard list of acceptable oil spill dispersants. Acute lethal toxicity tests with BP1100X and Sugee 2 showed that rainbow trout in fresh water were more sensitive than two marine fish, Fondulus heteroclitus and Menidia menidia, while fourth-stage larval lobsters, Homarus americanus, were the least sensitive. (Deal-EIS)
W80-03215

EFFECT OF A CHEMICAL DISPERSANT ON MICROBIAL UTILIZATION OF PETROLEUM HYDROCARBONS,
Rhode Island Univ., Kingston. Dept. of Plant Pathology-Entomology.
R. W. Traxler, and L. S. Bhattacharya.
In: Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L. T. McCarthy, Jr., G. P. Lindblom and H. F. Walter, Eds., American Society for Testing and Materials, p 181-187, 1978. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Oil, *Microbial degradation, *Toxicity, Oil spills, Organic compounds, Bacteria, Metabolism, Biochemical oxygen demand, Path of pollutants, Sea water, Water pollution control, *Dispersants, *Oil dispersants, *Crude oil, *Corexit.

The dispersant Corexit 9527 was found to enhance bacterial metabolism of Kuwait and South Louisiana crude oils as well as pure hydrocarbons in nonmechanically agitated seawater systems. Oxygen depletion, measured by a modification of the Biological Oxygen Demand (BOD) method, was used to determine the rate of substrate and mixed substrates oxidation by raw seawater populations of bacteria. This method demonstrated significantly increased oxidation of crude oil treated with dispersants. Mineralization studies, with 14C labeled hydrocarbon, substantiated the BOD results and also indicated that alkanes were metabolized prior to aromatic components in crude oils. (Deal-EIS)
W80-03216

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN THE SEDIMENTATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN DABOB BAY, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
F. G. Prahl, and R. Carpenter.
Geochimica et Cosmochimica Acta, Vol 43, p 1959-1972, 1979. 7 Fig, 4 Tab, 48 Ref.

Descriptors: *Path of pollutants, *Aromatic compounds, *Zooplankton, Bottom sediments, Seasonal, Runoff, Water chemistry, Water pollution sources, Diatoms, Phytoplankton, Chemical analysis, Gas chromatography, Lead radioisotypes, Radioactive dating, Aluminum, Dabob Bay, Washington, *Fecal pellets.

Polycyclic aromatic hydrocarbon (PAH) compositions were determined in plankton, sediment-trap-collected particulate material and sediment cores from Dabob Bay using a high performance liquid chromatographic/fluorescence technique. The annual flux of individual PAH measured in a series of sediment traps was compared with the flux of corresponding compounds determined from 210Pb dated bottom sediments. Systematic seasonal variations in the fluxes and concentrations of PAH, Al and organic carbon in the trap-collected particulates and seasonally collected plankton were also investigated to determine whether or not PAH are associated with either terrestrial or marine-derived materials. Concentrations of all PAH studied increased tenfold within the last 80-100 yr of sediment deposition, except for perylene which displayed a reasonably constant concentration profile. This suggests at least two sources contribute to the observed sedimentary PAH compositions in Dabob Bay, i.e., anthropogenic combustion and a natural source. Plankton and sediment trap-collected particulates contained PAH mixtures qualitatively similar to underlying surface sediments. Microscopic examination indicated fecal pellets were the major form of particulate material in the sediment traps. The fecal pellets collected in the sediment trap time series quantitatively account for essentially 100% of the PAH fluxes measured in the 210Pb dated sediments, implying zooplankton fecal pellets control the removal of PAH to Dabob Bay sediments. (Deal-EIS)
W80-03220

INITIAL TESTING OF A RECENT BIOLOGICAL MONITORING CONCEPT,
Virginia Polytechnic Institute and State Univ., Blacksburg. Center for Environmental Studies.
D. Gruber, J. Cairns, Jr., K. L. Dickson, A. C. Hendricks, and W. R. Miller, III.
Journal of the Water Pollution Control Federation, Vol 51, p 2744-2751, 1979. 7 Fig, 18 Ref.

Descriptors: *Bioindicators, *Sunfishes, *Bioassay, Monitoring, Industrial wastes, Fish physiology, Automation, Automatic control, Computers, Research equipment, Electrical equipment, Analytical techniques, Chlorination, Water chemistry, Oil spills, Chemical wastes.

The development of a recent concept of biological monitoring for continuously assessing industrial effluents is presented. Bluegill sunfish, Lepomis macrochirus, are used as biological sensors, and a small on-line computer facilitates the monitoring of the ventilatory rates of the fish, thereby automating the system. Chemical and physical monitors are also connected to the computer system, and an automatic refrigerated water sampler has been incorporated to facilitate more advanced chemical analysis. For the purpose of comparing the sensitivity of the present biological monitoring system with that of more conventional methods of toxicity testing, a continuous-flow acute bioassay unit is being included. Initial testing of the biomonitoring unit is being included. Initial testing of the biomonitoring system has demonstrated its practicality by incorporating a standard mixture from the petroleum industry (arbitrary reference mixture), a sodium hypoclorite solution, and chlorinated tapwater as test effluents. (Deal-EIS)
W80-03221

EFFECT OF ENVIRONMENTAL SALINITY OF HAEMOLYMPH AND TISSUES OF MUSSELS,
Akademiya Nauk SSSR, Leningrad. Lab. of Comparative Biochemistry of Inorganic Ions.
I. A. Skul'skii, I. V. Burovina, N. B. Pivovarova, T. I. Ivanova, and A. V. Lapin.
The Soviet Journal of Marine Biology, Vol 5, p 28-33, 1979. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Salinity, *Mussels, *Ions, Sodium, Animal physiology, Animal metabolism, Potassium, Habitats, Adaptation, Membrane processes, Osmosis, *Tissue analysis.

The content of ions in the tissues of mussels inhabiting seas with different salinities is investigated. The concentration of Na+ in the haemolymph of mussels and environment is always the same, while the distribution coefficient of K+ of haemolymph/environment increases as the salinity decreases. At the same time the absolute values of intracellular concentrations of K+ and Na+ in the muscles and nerve cells drop and the concentration gradients of cell/haemolymph change within narrow limits. (Deal-EIS)
W80-03222

INFLUENCE OF CERTAIN WASTE WATERS CONTAINING AMMONIA, UREA AND METHANOL ON UNICELLULAR MARINE ALGAE (IN FRENCH),
Institut Romania de Recherches Marines, Constantsa.
P-E. Mihnea.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 465-469, 1979. 4 Fig, 2 Tab, 2 Ref, (English abstract).

Descriptors: Water pollution effects, *Nutrients, *Phytoplankton, *Laboratory tests, Bioassays, *Ammonia, *Urea, Methanol, Domestic wastes, Industrial wastes, Laboratory tests, Algae, Phytoplankton, Nitzschia, Skeletonena, Chlamydomonas.

The results of experiments with waste waters (containing: methanol, ammonium, urea, and mixtures of these) on some unicellular algae are given (Nitschia and Chlamydomonas). The destructive or stimulating effects are presented as LT50, T90, recovering capacity, cells division, and have an essential specific feature. Ammonia is more toxic to

the algae than methanol. In very low concentrations these substances stimulate the division of the algae. In nature these substances stimulate the growth of algal blooms. (Katz-EIS)
W80-03227

LEVELS OF METAL POLLUTANTS IN SEDIMENTS AND BIOTA OF THE GULF OF TRIESTE: A LONG TERM SURVEY,
Trieste Univ. (Italy). Inst. of Hygiene.
L. Majori, G. Nedoclan, G. B. Modonutti, and F. Davis.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 237-243, 1979. 1 Fig, 6 Tab, 3 Ref.

Descriptors: *Metals, *Monitoring, *Aquatic environment, *Bioindicators, Trace elements, *Cadmium, *Cobalt, *Chromium, *Copper, *Iron, *Mercury, Manganese, Nickel, *Lead, *Zinc, Mussels, Water chemistry, Bottom sediments, Marine fish, Mullets, *Arsenic, *Tissue analysis, *Bioaccumulation.

Given is a summary of observations made over several years regarding the content of trace elements (As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn) in the components of the marine environment (e.g. sea water, sediments, and various species of fish). Our studies of contamination levels show that Mytilus galloprovincialis LmK is a practical and simple research tool for monitoring marine metal pollution. It is suggested that these 'biological samplers' be used on a large scale, so as to make it possible to draw a map of metal pollution. (Deal-EIS)
W80-03228

TRACE ELEMENTS IN PELAGIC ORGANISMS AND A PELAGIC FOODCHAIN OF THE AEGEAN SEA,
Democritus Nuclear Research Center, Athens (Greece). Radioanalytical Lab.
C. Papadopoulou, D. Zafiropoulos, I. Hadjistelios, M. Vassilaki-Grimani, and C. Yannopoulos.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 231-232, 1979.

Descriptors: *Food chains, *Path of pollutants, *Trace elements, *Zinc, *Cobalt, *Cesium, Chemical analysis, Marine fish, Plankton, Water chemistry, Metals, *Selenium, *Rubidium, *Vanadium, *Arsenic, *Tissue analysis, *Biomagnification.

Plankton, Euphasia kronii, and the pelagic fish species Trachurus mediterraneus and Scomber japonicus colias were analysed for the elements As, V, Se, Co, Cs, Zn and Rb. Concentrations of As, Zn, Co, Se, and Rb in Scomber compared well to those in Trachurus whereas V values were one order of magnitude higher in Trachurus. Assuming that the plankton samples of different size and Trachurus represent 5 different levels of a pelagic food chain, no trend of food chain magnification was observed. (Deal-EIS)
W80-03229

POLLUTION MONITORING OF ELEVEN TRACE ELEMENTS IN THREE MARINE ORGANISMS FROM SARONIKOS GULF, GREECE,
Democritus Nuclear Research Center, Athens (Greece). Radioanalytical Lab.
A. P. Grimanis, C. Papadopoulou, D. Zafiropoulos, M. Vassilaki-Grimani, and N. Tsimenidis.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 233-234, 1979. 1 Fig.

Descriptors: *Trace elements, Monitoring, *Water chemistry, *Cadmium, *Cobalt, *Chromium, *Cesium, *Iron, *Mercury, *Zinc, *Mullets, Mussels, Chemical analysis, Water quality standards, Water pollution effects, *Silver, *Rubidium, *Selenium, *Tissue analysis, *Antimony, Greece, Saronicos Gulf.

Levels of eleven trace elements (Ag, Cd, Co, Cr, Cs, Fe, Hg, Rb, Sb, Se, and Zn) have been determined by neutron activation analysis in the muscle of Mullus barbatus and Parapenaeus longirostris as well as in the whole body of Mytilus galloprovincialis from Saronicos Gulf, Greece, during a two-year period (1975-1977). Only one Hg value (570 ug/kg wet weight) was found to be slightly higher than the WHO maximum permissible level. No significant seasonal or geographic variations were observed except for P. longirostris specimens collected during summer 1976 from a single station. No pollution effects were noted. (Deal-EIS)
W80-03230

TRACE METALS AND ORGANOCHLORINE RESIDUE CONTENT OF MULLIDAE FAMILY FISHES AND SEDIMENTS IN THE VICINITY OF ERDEMLI (ICEL), TURKEY,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Science.
T. I. Balkas, I. Salihoglu, G. Tuncel, S. Tugrul, and G. Ramelow.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 159-163, 1979. 2 Tab, 15 Ref.

Descriptors: *Heavy metals, *Chlorinated hydrocarbon pesticides, *Mullets, Gas chromatography, Spectrometry, Chemical analysis, *Mercury, *Copper, *Cadmium, *Zinc, *Lead, *DDT, DDD, DDE, Aldrin, Dieldrin, *Polychlorinated biphenyls, Pesticide residues, Bottom sediments, Turkey, Erdemli, *BHC, *Heptachlor, *Tissue analysis.

The organochlorine residue content of three members of the mullidae family, i.e., Mullus barbatus, Mullus surmuletus and Upenus moluccensis caught in the vicinity of Erdemli has been investigated with the aid of gas chromatography. Some trace metals such as Hg, Cu, Cd, Zn, and Pb in the same species have also been investigated with atomic absorption spectrometry. Sediment samples of the area were analysed and their organochlorine residue and trace metal contents determinated. (Deal-EIS)
W80-03231

TRACE ELEMENTS IN MESOPELAGIC AND SOME COASTAL FISH FROM THE ADRIATIC,
Nuklearni Inst. Jozef Stefan, Ljubljana (Yugoslavia).
P. Stegnar, L. Kosta, V. Ravnik, J. Stirn, and A. R. Byrne.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 235-236, 1979. 2 Tab, 5 Ref.

Descriptors: *Trace elements, *Marine fish, Chemical analysis, *Copper, *Mercury, *Manganese, *Zinc, Water chemistry, Heavy metals, Path of pollutants, *Arsenic, *Antimony, *Tissue analysis, *Arsenic, *Antimony, *Selenium, *Adriatic Sea.

Trace elements (As, Cu, Hg, Mn, Sb, Se, Zn) were determined in 6 species of mesopelagic fish (Argyropelecus hemigymnus, Diaphus rafinesqui, Gonichtys coccoi, Maurolicus pennanti, Notoscopelus elongatus, Scopelus benoiti) and 2 selected coastal fish samples (Boops boops, Pagellus erythrinus) from different sampling stations from the Adriatic. When compared to the trace element contents found in coastal fish, it was evident that only Hg concentrations were higher in coastal fish, while the opposite situation was found for Zn. The concentration level for the other elements was nearly the same in mesopelagic and coastal fish specimens. (Deal-EIS)
W80-03233

MERCURY CONCENTRATIONS IN PELAGIC FISHES (ANCHOVY, MACKEREL AND SARDINE) FROM THE ITALIAN COAST AND STRAIT OF GIBRALTAR,
Siena Univ. (Italy). Lab. di Idrobiologio.
F. Baldi, A. Renzoni, and M. Bernhard.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 251-254, 1979. 4 Fig, 4 Ref.

Descriptors: *Mercury, *Marine fish, Chemical analysis, Habitats, Water chemistry, Geochemistry, Path of pollutants, Coasts, Heavy metals, Growth rates, *Anchovy, *Engraulis, *Scomber, *Sardina, *Mediterranean Sea, *Tissue analysis, *Bioaccumulation, *Italy.

Mercury body burden in Engraulis encrasicolus, Scomber scomber, S. japonicus and Sardina pilchardus caught in Italian coastal waters were compared with the body burden of specimens from the same species obtained from varied locations in the Strait of Gibraltar. The Hg/weight ratio was significantly smaller in the fishes from Strait of Gibraltar than in the fishes from the Italian coast. Because of their pelagic habitat the specimens from the Italian coast cannot be contaminated from anthropogenic sources. Their higher Hg body burden must be due to the higher natural Hg concentration in the marine and terrestrial environment near geochemical Hg anomalies. In Mediterranean fishes the Hg body burden was about twice that of the specimens of the same size from the Atlantic. Similar higher body burden was found in Mediterranean tuna which prey on these pelagic fishes. (Deal-EIS)
W80-03236

MONITORING OF CHLORINATED HYDROCARBONS IN WATER AND SEDIMENTS OF THE NORTH ADRIATIC COASTAL WATERS,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
N. Picer, and M. Picer.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 133-136, 1979. 2 Fig, 4 Ref.

Descriptors: *Pesticide residues, *Polychlorinated biphenyls, *Monitoring, Chlorinated hydrocarbon pesticides, DDT, Water chemistry, Bottom sediments, Chemical analysis, Path of pollutants, Analytical techniques, *Adriatic Sea.

Persistent chlorinated hydrocarbons in more than 50 water and sediment samples were analysed over a two-year period (1977-78). Analyses were performed on subsurface water samples collected at a depth of 1 m and on samples collected from several surface slicks by means of a Garrett net. Sediment samples were collected by grab sampler. The results of monitoring of chlorinated hydrocarbons in sea-water samples are discussed from the viewpoint of the analytical difficulties. Some explanations concerning the influence of local pollution sources on the level of chlorinated hydrocarbons in coastal waters of the North Adriatic are given. (Deal-EIS)
W80-03237

MONITORING OF CHLORINATED HYDROCARBONS IN BIOTA AND SEDIMENTS OF SOUTH ADRIATIC COASTAL WATERS,
Biological Inst., Dubrovnik (Yugoslavia).
D. Vilicic, N. Picer, M. Picer, and B. Nazansky.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 143-146, 1979. 2 Fig, 5 Ref.

Descriptors: *Pesticide residues, *Monitoring, *Aquatic life, *DDT, DDE, Dieldrin, *Polychlorinated biphenyls, Chlorinated hydrocarbon pesticides, Gas chromatography, Mollusks, Crustaceans, Fish populations, Plankton, Mussels, Sediments, Mullets, Crabs, Oysters, *Adriatic Sea, *Tissue analysis.

During a two year-period of monitoring of chlorinated hydrocarbons in South Adriatic coastal waters, 55 biota (molluscs, crustaceans, fishes, plankton) and sediment samples were collected. Determinations of DDT, TDE, DDE, dieldrin, and PCBs were performed by means of gas chromatography. These data are related to possible sources of pesticide applications. (Deal-EIS)
W80-03238

ACCUMULATION AND DISTRIBUTION OF HEAVY METALS IN SOME MARINE ORGANISMS IN THE BAY OF IZMIR AND IN AEGEAN COASTS,
Ege Univ., Izmir (Turkey). Dept. d'Oceanographique Biologique.
H. Uysal.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 213-217, 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Heavy metals, *Spatial distribution, *Fish populations, *Mercury, *Cadmium, *Copper, *Cobalt, *Chromium, *Manganese, *Zinc, *Iron, *Lead, *Mussels, Mullets, Crabs, Seasonal, Fish migrations, Path of pollutants, Shrimp, *Tuna, *Tissue analysis, Marine fish, Turkey, *Mediterranean Sea, Bay of Izmir.

Concentrations of heavy metals (Hg, Cd, Cu, Co, Cr, Mn, Zn, Fe, Pb) have been measured in Mytilus galloprovincialis, Penaeus kerathurus, Mullus barbatus, Mullus surmuletus, Mugil sp., Thunnus thynnus, Carcinus mediterraneus, over their range of distribution in the bay of Izmir and Aegean coast (Turkey). Mugil sp. and Mullus sp. are most abundant along the coasts of the Aegean. M. galloprovincialis is not found in the south part of Izmir Bay and all the southern part of Turkey. P. kerathurus is found in relatively normal amounts along the Aegean coasts; but in some localities it is very rare. Thunnus thynnus thynnus are most abundant during migration seasons along the Aegean coasts. A comparison of the concentrations of heavy metals in these marine animals which represent different environmental conditions has been determined seasonally for each locality. According to our results the heavy metals concentration of C. mediterraneus was higher than the other species mentioned and the concentration of elements vary according to species, locality and seasons of the year. (Deal-EIS)
W80-03239

THE EFFECT OF DDT AND HEXACHLORANE ON ASSIMILATION AND OUTFLOW OF 14C IN PHRAGMITES COMMUNIS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
T. I. Shokod'ko, A. I. Merezhko, and A. I. Lyashenko.
Hydrobiological Journal, Vol 14, No 4, p 91-95, 1978. 1 Fig, 2 Tab, 3 Ref.

Descriptors: *Pesticide kinetics, *Aquatic plants, *Plant physiology, *DDT, Carbon radioisotopes, Radiochemical analysis, Tracers, Photosynthesis, Toxicity, Path of pollutants, Chlorinated hydrocarbon pesticides, Root systems, *Hexachlorane.

The assimilation of 14CO2 by reeds is reduced under the influence of DDT and hexachlorane. That the pesticides have a specific effect on the reaction of photosynthesis and a general toxic effect may be suggested from the shape of the curves showing the dependence of the rate of assimilation of 14CO2 on pesticide concentration. The reed is more resistant to DDT than to hexachlorane. A redistribution of 14C occurred in the organs of the reed under the influence of the organic chlorine pesticides. As the concentrations of the preparations increased there was a rise in the absolute amount of radiocarbon flowing into the roots; the mean rate of outflow into the roots is also increased against the background of an increase in the relative outflow of 14C-labeled assimilates. Intensification in the outflow of assimilates into the roots in the presence of DDT and hexachlorane is a defense reaction of the reed to the action of the toxic agent. (Deal-EIS)
W80-03240

HEAVY METALS AND CHLORINATED HYDROCARBONS IN PELAGIC ORGANISMS FROM THE OPEN MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. W. Fowler, J. La Rosa, Y. Unlu, B. Oregioni, and J. P. Villeneuve.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 155-158, 1979. 9 Ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Heavy metals, *Aquatic environment, Trophic levels, Chemical analysis, Pesticide residues, Polychlorinated biphenyls, DDT, Zinc, Iron, Cobalt, Cesium, Mercury, Plankton, Food chains, Mediterranean Sea, *Tissue analysis, *Tuna, *Arsenic, *Vanadium, *Silver, *Rubidium, *Antimony, *Scandium.

During 1977 pelagic organisms ranging in size from microplankton to tuna were sampled throughout the Mediterranean and analysed for selected heavy metals and chlorinated hydrocarbons. Wherever possible, zooplankton and nekton were sorted into species in order to aid in determining spatial and temporal trends in contaminant levels. Although the data are far from complete for all species, results to date for both categories of pollutants indicate that levels in open Mediterranean organisms in most cases are similar to those reported for pelagic species from other oceanic regions. (Deal-EIS)
W80-03241

SOME OBSERVATIONS ON THE REPRODUCTION AND EMBRYONIC DEVELOPMENT OF FIVE SPECIES OF FISH KEPT IN EXPERIMENTAL RADIOACTIVE WATER BODIES,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
S. P. Muntyan.
Journal of Ichthyology, Vol 18, No 6, p 1033-1038, 1978. 2 Tab, 34 Ref.

Descriptors: *Toxicity, *Strontium radioisotopes, *Embryonic growth stage, Strontium, Cesium, Fish physiology, Animal growth, Animal pathology, Radioactivity effects, Aquaculture, Mortality, *Teratogens, *Tissue analysis.

The reproduction and embryonic development of pike (Esox lucius), perch (Perca fluviatilis), roach (Rutilus rutilus), crucian carp (Carassius carassius) and common wild goldfish (Carassius auratus gibelio) inhabiting radioactive water (Sr-90 and Cs-137) were studied. Normal embryos of all five species survived until complete absorption of the yolk. Following that period abnormalities were noted, including: curvatures of the body; deformation and incomplete development of myotomes; 'dropsy' of the pericardial cavity and the body cavity; and, disturbances of the cardiovascular system. The feasibility of raising fish in low-level radioactively contaminated water is also discussed. (Deal-EIS)
W80-03244

ON THE CORRESPONDENCE OF DATA ON THE INCUBATION OF FISH EGGS IN SOLUTIONS OF STRONTIUM-90 -- YTTRIUM-90 OF VARYING ACTIVITY UNDER LABORAROTY CONDITIONS AND IN NATURAL WATERS,
Vserossiiskii Nauchno-Issledovatelskii Inst. Prudpvpgp Rybnogo Khozyaistva, Moscow (USSR).
V. L. Pechkurenkov, and G. L. Pokrovskaya.
Journal of Ichthyology, Vol 18, No 6, p 995-1004, 1978. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Fish eggs, *Strontium radioisotopes, *Radiation, Cesium, Radioactivity effects, Toxicity, Size, Fish physiology, Mortality, Genetics, Growth stages, Mode of action, Chromosomes, Sediments, *Yttrium radioisotopes.

Data are presented on the incubation of fish eggs under laboratory conditions in solutions of strontium-90 -- yttrium-90 with a varying activity and in natural waters artificially polluted with strontium-90 -- yttrium-90 and cesium-137. Ways of calculating the correction coefficients for the geometry (sizes) of the eggs when calculating the doses are given. The dose load per egg which is incubated in solutions of strontium-90 -- yttrium-90, prepared from tap water, is determined by the level of accumulation of these radionuclides by the developing egg, while the dose load obtained by the developing egg in a natural body of water, will be determined by the extent of silting up of the egg and the coefficient of radionuclide accumulation in the ooze. (Deal-EIS)
W80-03250

PHYSIOLOGICAL-BIOCHEMICAL DATA ON EXPERIMENTAL INTOXICATION OF FISH WITH 'YALAN',
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
K. K. Vrochinskiy, and G. V. Zemkov.
Journal of Ichthyology, Vol 18, No 6, p 1004-1009, 1978. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Herbicides, *Toxicity, *Carp, Larval growth stage, Mortality, Bioassay, Lethal limit, Mode of action, Thiocarbamate pesticides, Fish behavior, Amino acids, Pesticide toxicity, Fish physiology, Animal metabolism, *Yalan, *Blood chemistry, *Glucose, *Tissue analysis.

The limits of the toxicity of the herbicide 'yalan' for 8 day old larvae of the carp, Cyprinus carpio were established. At the moment of intoxication the motor activity is decreased in second year carp with simultaneous increase in the amount of ammonia, urea and hydroperoxides of the lipids in the dorsal white muscle. The amount of glucose in the blood is simultaneously reduced. Herbicide concentrations in water within the limits of 4.5-72 mg/l are acutely toxic for the young of the carp. 2.2 mg/l or less of 'yalan' should be considered as subacute or chronic concentrations. (Deal-EIS)
W80-03251

POLYCYCLIC AROMATIC HYDROCARBON CARCINOGENS IN COMMERCIAL SEAFOODS,
British Columbia Cancer Research Center, Vancouver.
B. P. Dunn, and J. Fee.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1469-1476, 1979. 4 Tab, 32 Ref.

Descriptors: *Pollutant identification, *Commercial fish, *Commercial shellfish, Crab, Shrimp, Lobster, Mollusks, Clams, Mussels, Salmon, Trout, Aromatic compounds, Poisons, Creosote, Chemical wastes, Industrial wastes, Gas chromatography, Public health, *Tuna, *Cod, *Sole, *Tissue analysis, *Carcinogens, *Benzo(a)pyrene.

Fresh and processed commercial seafoods were analyzed for the polycyclic aromatic hydrocarbon carcinogen benzo(a)pyrene using a thin-layer chromatographic separation technique and quantitation by fluorescence. Commercial samples of vertebrate fish did not contain detectable levels, except where fish were packed with vegetable oil, an exogenous source of carcinogens. Levels in most shellfish samples were generally less than 10 nannog/g wet weight, but occasional samples contained up to 36 nannog/g. Crab and shrimp samples contained little or no benzo(a)pyrene (ND to 0.5 nannog/g). Commercial lobsters contained 0.8 to 7.9 nannog/g. The source of contamination of lobsters was further investigated, utilizing high pressure liquid chromatography to measure 13 polycyclic aromatic hydrocarbon isomers. Freshly caught lobsters had less than 1 nannog/g benzo(a)pyrene. Lobsters which had been kept in a commercial tidal pound constructed of creosoted timber contained highly elevated levels of benzo(a)pyrene and other carcinogenic hydrocarbons, including chrysene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The maximum level of benzo(a)pyrene was 2300 nannog/g wet weight in digestive gland, and 281 nannog/g in edible tail meat. These levels are substantially higher than previously reported for

any foodstuff, and are most probably attributable to creosote contamination during impoundment. (Deal-EIS)
W80-03252

ASSIMILATION EFFICIENCY OF DIETARY METHYLMERCURY BY NORTHERN PIKE (ESOX LUCIUS),
Montana State Univ., Bozeman. Dept. of Biology.
G. R. Phillips, and R. W. Gregory.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1516-1519, 1979. 2 Tab, 19 Ref.

Descriptors: *Mercury, *Path of pollutants, *Pikes, Carp, Predation, Growth stages, Fish physiology, Trophic level, Heavy metals, Fish diets, *Tissue analysis, *Bioaccumulation, *Methylmercury.

Northern pike (Esox lucius) retained an average of 19% (range 6-31%) of the methylmercury which they ingested during consumption of young-of-the-year carp (Cyprinus carpio) collected from a pond; carp accumulated methylmercury naturally while in the pond. The total amount of mercury in pike increased with time (up to 42d) but concentration in the tissue decreased due to growth dilution; duration of ingestion did not influence efficiency of methylmercury assimilation. This value (19%) is considerably lower than most efficiencies reported in the literature, demonstrating that methylmercury in this forage fish is less readily available to a predator fish than previous studies implied. (Deal-EIS)
W80-03253

WAX ESTERS IN THE MARINE ENVIRONMENT: ORIGIN AND COMPOSITION OF THE WAX FROM BUTE INLET, BRITISH COLUMBIA,
Skidaway Inst. of Oceanography, Savannah, GA.
R. F. Lee, and J. C. Nevenzel.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1519-1523, 1979. 2 Tab, 29 Ref.

Descriptors: *Copepods, *Pollutant identification, *Lipids, Organic compounds, Chemical analysis, Chromatography, Animal physiology, Biochemistry, Mortality, Seasonal, Winter, Zooplankton, Bute Inlet, British Columbia, *Wax esters.

During severe winters large amounts of a solid lipid accumulate on the water surface and on the shores of Bute Inlet, a deep fjord on the mainland of British Columbia. Chromatographic analyses show that this wax consists chiefly of wax esters (48%), with minor amounts of hydrocarbons (4%) and triacylglycerols (6%). Dominant among the zooplankton in this inlet is the copepod Calanus plumchrus, which also is rich in wax esters (40-50% of dry weight). Except for the lack of polyunsaturation in Bute Inlet wax there is a close similarity between the wax ester, alcohol, and fatty acid compositions of C. plumchrus and Bute Inlet wax. The major hydrocarbon of both is pristane. We hypothesize that Bute Inlet wax is produced by some major change in water conditions which cause a massive kill of copepods. At winter temperatures this lipid is a solid and as such may accumulate on the beach. Copepods are the likely source for the wax esters in slicks and sediments reported from oceanic areas throughout the world. (Deal-EIS)
W80-03254

ACCUMULATION AND EXCRETION OF 95ZR AND 95NB BY COMMON GOBY (ACANTHOGOBIUS FLAVIMANUS),
National Inst. of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
Y. Suzuki, M. Nakahara, and T. Ueda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 10, p 1293-1298, 1979. 7 Fig, 2 Tab, 20 Ref.

Descriptors: *Radioisotopes, *Absorption, *Marine fish, Radiochemical analysis, Tracers, Path of pollutants, Fish physiology, Animal metabolism, Fallout, Radioactive wastes, Nuclear powerplants, *Bioaccumulation, *Tissue analysis, *Depuration, *Goby-fish, *Niobium radioisotopes, Zirconium radioisotopes.

In order to gain more information on 95Zr and 95Nb accumulation and excretion by marine fish, a laboratory study was undertaken using common goby. Radioactivity of 95Zr and 95Nb in the tissues or organs was simultaneously measured and readily distinguished by a high resolution detector. More than 60% of both total body burden of 95Zr and 95Nb was concentrated in the viscera (mainly digestive tracts) in spite of the small weight per cent (1.3%). The concentration factors of 95Zr and 95Nb on the 14th day after exposure were 34 and 42 for viscera; however, those were estimated to reach 70 and 83, respectively, if the fish were reared for a month under a constant level of radioactivity in sea water. The turnover rate for viscera was 0.0081 for 95Zr and 0.0018 for 95Nb, and the biological half-life was 85 days for 95Zr and 385 days for 95Nb, respectively. (Deal-EIS)
W80-03256

A FAST INDICATOR FOR DETECTING GROSS POLLUTION BY HAZARDOUS CHEMICALS,
Auckland Regional Authority, (New Zealand). Water Lab.
T. L. Shaw.
New Zealand Journal of Marine and Freshwater Research, Vol 13, No 3, p 393-394, 1979. 1 Tab, 4 Ref.

Descriptors: *Bioindicators, *Rainbow trout, *Chemical wastes, Copper compounds, Poisons, Monitoring, Mortality, Water quality, Fish physiology, Animal metabolism, Fish behavior, Analytical techniques, *Cyanides.

Median survival, 10% mortality, and 10% turnover times of rainbow trout, Salmo gairdneri Richardson, were compared in solutions containing copper or cyanide ions. For all concentrations of poisons (0.5, 1.0, and 2.0 g/cubic meter of copper as Cu2+ and 0.3, 0.5, 1.0, and 5.0 g/cubic meter of cyanide, as KCN), the times for turnover were the least. These were short enough (4.5-96 min) to be of use in monitoring waters which are being abstracted by water treatment plants. The method may be generally applicable for detection of gross forms of pollution by hazardous chemicals. (Deal-EIS)
W80-03257

INDICATORS OF PHOSPHORUS AND NITROGEN DEFICIENCY IN FIVE ALGAE IN CULTURE,
Department of Fisheries and Marine Services, Winnipeg (Manitoba). Freshwater Inst.
F. P. Healey, and L. L. Hendzel.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1364-1369, 1979. 7 Fig, 16 Ref.

Descriptors: *Aquatic algae, *Nutrient requirements, *Bioindicators, Phosphorus, *Nitrogen, Nutrients, Absorption, Chlamydomonas, Scenedesmus, Anabaena, Chlorophyta, Cyanophyta, Metabolism, Proteins, Carbohydrates, Biochemistry, Enzymes, *Ammonium.

Five freshwater algae (Chlamydomonas reinhardi, Scenedesmus quadricauda, Anabaena variabilis, Pseudoanabaena catenata, and Cryptomonas erosa) were grown in batch culture without nutrient limitation and with various degrees of P and N limitation. They were analysed for several aspects of composition and some metabolic activities of potential use as indicators of nutrient deficiency to aid in establishing values indicative of the presence or absence of nutrient deficiency. Ratios of N/C, P/C, N/P, protein/C, carbohydrate/C, and protein/carbohydrate most clearly differentiated between no, P, and N deficiency. The initial saturated rate of phosphate uptake, P debt, and alkaline phosphatase activity increased distinctly in P deficiency in some of the algae but not in others. Similarly, the initial saturated rate of ammonium uptake and N debt rose in some but not all N-deficient algae. Cryptomonas erosa tended to form walled resting cells (cysts) during growth into P or N deficiency. (Deal-EIS)
W80-03258

PCBS AND DDE IN COMMERCIAL FISH FEEDS,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac, L. W. Nicholson, and C. A. McCauley.
The Progressive Fish Culturist, Vol 41, No 4, p 210-211, 1979. 1 Tab, 6 Ref.

Descriptors: *Pesticide residues, *Fish diets, *Fish food organisms, DDE, Polychlorinated biphenyls, Brine shrimp, Aroclors, Chlorinated hydrocarbon pesticides, Gas chromatography, Path of pollutants, Fish hatcheries, *Commercial fish feeds.

Three commercial fish feeds were analyzed for PCBs and p,p'DDE and were reported in dry weight concentrations. In various sizes of Oregon Moist Pellets, concentrations of PCBs ranged from less than 0.10 to 0.30 microg/g and those of p,p'DDE from less than 0.01 to 0.47 microg/g. In Silver Cup, concentrations of PCBs were 0.06 to 0.07 microg/g, and p,p'DDE, 0.01 to 0.06 microg/g. Nauplii of brine shrimp (Artemia salina) contained 0.14 microg/g PCB and 0.03 microg/g p,p'DDE. (Deal-EIS)
W80-03259

UPTAKE OF HYDROCARBONS BY THE MARINE DIATOM CYCLOTELLA CRYPTICA,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
M. Karydis.
Microbial Ecology, Vol 5, p 287-293, 1980. 3 Fig, 3 Tab, 22 Ref.

Descriptors: *Diatoms, *Absorption, *Oil, Cytological studies, Marine algae, Metabolism, Chemical analysis, Gas chromatography, Organic compounds, Aromatic compounds, Phytoplankton, *Bioaccumulation, *Paraffins, *Alkanes.

The accumulation of exogenous hydrocarbons by the marine diatom Cyclotella cryptica grown in culture has been studied using gas chromatography. Exposure of the alga to paraffins for 10 days results in accumulation of n-alkanes having between C13 and C16 carbon atoms. The C16 level in the accumulated fraction is twice as high as that in the original oil. (Deal-EIS)
W80-03267

PRELIMINARY RESULTS ON UPTAKE AND ELIMINATION AT DIFFERENT TEMPERATURES OF P,P'-DDT AND TWO CHLOROBIPHENYLS IN PERCH FROM BRACKISH WATER,
National Swedish Environment Protection Board, Stockholm. Research Lab.
M. Edgren, M. Olsson, and L. Renberg.
Ambio, Vol 8, No 6, p 270-272, 1979. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Cooling waters, *Pesticide kinetics, *Fish physiology, Absorption, *DDT, *Polychlorinated biphenyls, Chlorinated hydrocarbon pesticides, Pesticide residues, Perches, Water temperature, Nuclear powerplants, Path of pollutants, *Bioaccumulation, *Tissue analysis.

Cooling water discharged by nuclear power plants usually causes a local temperature rise of up to 10C in the recipient water body. This study investigated how such a temperature increase influences the accumulation and elimination of p,p'-DDT and two chlorobiphenyls chosen as representative for PCBs in perch (Perca fluviatilis) at various water temperatures. In the accumulation experiment a temperature difference of 10C resulted in doubled concentrations of the studied chlorinated hydrocarbons. In the elimination experiment, concentrations of the chlorinated hydrocarbons decreased after one week of recovery, but no significant difference in their elimination was observed among fish kept at different temperatures. However, the three organochlorines studied showed different elimination rates. The preliminary results indicate that the bioaccumulation of DDT and PCB increases in fish living in a cooling water recipient. (Deal-EIS)

W80-03268

HEAVY METALS (HG, CD, CU, PB, ZN) IN LIVER AND MUSCLE TISSUE OF FRESHWATER PERCH (PERCA FLUVIATILIS) OF THE LAKE OF BIEL AND THE WALENSEE (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
V. H.-R. Hegi, and W. Geiger.
Schweizerische Zeitschrift fur Hydrobiologie, Vol 21, No 1, p 94-107, 1979. 12 Tab, 19 Ref.

Descriptors: *Heavy metals, *Lakes, *Perches, *Mercury, *Lead, *Copper, *Cadmium, *Zinc, Chemical analysis, Fish physiology, Animal metabolism, Water quality standards, *Tissue analysis, *Liver, *Muscle.

Liver and muscle tissue from fish caught between 1973 and 1975 in two Swiss lakes, namely the Lake of Biel and the Walensee, were analyzed for the heavy metals Hg, Cd, Cu, Pb and Zn. The research project was carried out within the framework of an international OECD program. The comparison of metal concentrations in fish originating from the two lakes revealed for the Lake of Biel higher Hg values throughout and higher Cu and Zn values in the livers, whereas for the Walensee the Cd values were formed to be higher in the livers. The Pb concentrations did not differ significantly. With regard to the examined organs (livers and muscles) the comparison showed higher Hg concentrations in the muscles than in the livers. The Cd, Cu, Pb and Zn concentrations, however, were found to be higher in the livers. Not a single fish sample exceeded Switzerland's admissible tolerance level for Hg, namely 0.5 mg/kg in fish meat. (Deal-EIS)
W80-03269

PURIFICATION AND PROPERTIES OF SOLUBLE ARYLSULPHATASES ISOLATED FROM HEPATOPANCREAS OF THE SHRIMP CRANGON CRANGON L.
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
G. Drewa, T. Dabrowska, Z. Zbytniewski, and F. Pautsch.
Kieler Meeresforschungen, Vol 4, p 360-365, 1978. 2 Fig, 4 Tab, 6 Ref.

Descriptors: *Enzymes, *Inhibition, *Detergents, *Shrimp, Animal metabolism, Animal physiology, Biochemistry, Oil, Fuels, Surfactants, Chromatography, Chemical properties, Mode of action, *Tissue analysis, *Arysulphatases.

Arylsulphatase A and B were isolated from the hepatopancreas of the shrimp Crangon crangon L. after 7 days incubation in 50 ppm of detergent 'SOLO'. Arylsulphatase A,B-1 and B-2 were isolated from the hepatopancreas of the shrimp C. crangon L. incubated in pure brackish water (salinity 7 o/oo). Heavy and light fuel oil added to the enzyme in vitro in concentrations of 2.0% inhibit the activity of arylsulphatase A to a greater degree than arylsulphatase B (14.4% and 5.5% respectively). Detergent 'SOLO' (mixture of nonionic and anionic detergents) in the concentrations of 0.5% arylsulphatase A and for 91% arylsulphatase B, whereas in concentrations of 2.0% it inhibits arylsulphatase A for 91.7% and arylsulphatase B for 100%. (Deal-EIS)
W80-03278

ISOLATION AND ELEMENTAL ANALYSIS OF METAL-RICH GRANULES FROM THE KIDNEY OF THE SCALLOP, PECTEN MAXIMUS (L.),
Natural Environment Research Council, Aberdeen (Scotland). Inst. of Marine Biochemistry.
S. G. George, B. J. S. Pirie, and T. L. Coombs.
Journal of Experimental Marine Biology and Ecology, Vol 42, p 143-156, 1980. 5 Fig, 4 Tab, 21 Ref.

Descriptors: *Metals, *Cytological studies, Animal metabolism, Calcium, *Manganese, *Zinc, *Phosphorus, *Magnesium, *Copper, *Iron, *Cadmium, Potassium, *Sulfur, Chlorine, Chemical analysis, Electron microscopy, Biological membranes, Animal physiology, Path of pollutants, *Pecten, *Scallops, *Tissue analysis, *Kidney.

Excretory granules from the kidney of the scallop, Pecten maximus (L.), have been isolated and purified. Their morphology has been determined by electron microscopy and their elemental composition by electron-probe X-ray micro-analysis. The granules, varying in size from 5-15 um diameter, are inorganic in nature and contain Ca, Mn, Zn, and P, equivalent to 75% of their dry weight, with Mg, Cu, Fe, Cd, K, S, and Cl also present in much smaller amounts. The granules show large variations in elemental composition but the sum of the metals is always close to equimolarity with the phosphorus content. Electron microscopy of the kidney tissue showed that there is a gradual development of the granules from lysosomal membranous vesicles to highly mineralized membrane-limited vacuoles or residual bodies, which are eventually excreted as such into the urinary tract. (Deal-EIS)
W80-03282

EFFECT OF LONG-TERM LEAD EXPOSURE ON THE SEAWATER AND SEDIMENT BACTERIA FROM HETEROGENEOUS CONTINUOUS FLOW CULTURES,
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.). Dept. of Bacteriology.
T. L. Tan.
Microbial Ecology, Vol 5, p 295-311, 1980. 6 Fig, 6 Tab, 46 Ref.

Descriptors: *Lead, *Bacteria, *Toxicity, *Growth rates, Heavy metals, Resistance, Marine bacteria, Seawater, Absorption, Sediments, Aerobic bacteria, Anaerobic bacteria, Azotobacter, Nitrogen fixing bacteria, Adaptation.

Lead-influenced changes of the composition of seawater and sediment bacteria were studied in two flow cultures run with lead-contaminated artificial seawater (1 mg Pb2+/l) and one control culture. During the experiment viable counts of physiological groups of bacteria from the control culture were not significantly different from that of the lead-contaminated cultures. Lead tolerance of seawater and sediment bacteria strains was investigated. Comparisons of growth yields showed that lead tolerance of seawater and sediment bacteria was lost again if the bacteria were cultivated in a medium without lead. Lead tolerance could not be demonstrated for the sediment bacteria of one lead-contaminated culture. Heterotrophic uptake measurements with radioactive glucose indicated that seawater bacteria from the lead-contaminated cultures adapted to lead pollution. The sediment bacteria, however, did not reveal lead tolerance by this method. Fluctuations in lead content of the sediment as well as of the overlying seawater gave indications of adsorption-desorption processes between seawater and sediment. Lead was not homogeneously distributed at the sediment surface. (Deal-EIS)
W80-03283

CONCENTRATIONS OF ARSENIC, SELENIUM AND TEN HEAVY METALS IN SCHOOL SHARK, GALEORHINUS AUSTRALIS (MACLEAY), AND GUMMY SHARK, MUSTELUS ANTARCTICUS GUNTHER, FROM SOUTH-EASTERN AUSTRALIAN WATERS,
Victoria Dept. of Agriculture, Melbourne (Australia).
J. W. Glover.
Australian Journal of Marine and Freshwater Research, Vol 30, p 505-510, 1979. 1 Tab, 13 Ref.

Descriptors: *Sharks, *Heavy metals, *Baseline studies, *Cadmium, *Copper, *Manganese, *Zinc, *Cobalt, *Chromium, *Lead, *Nickel, *Molybdenum, Path of pollutants, Chemical analysis, Spectrophotometry, *Arsenic, *Selenium, *Tissue analysis, *Bioaccumulation.

The maximum concentrations of arsenic, cadmium, copper, manganese, selenium and zinc in the edible flesh of G. australis and M. antarcticus were found to be 30, 0.08, 0.6, 0.8 and 4.8 micro/g, wet weight respectively. The concentrations of cobalt, chromium, lead, molybdenum and nickel were below the limits of detection, namely 0.3, 0.5, 0.1, 0.2 and 0.2 microg/g, wet weight respectively, of the methods used. Samples for analysis were taken from one male and one female shark of each species caught in six areas in south-eastern Australian waters. Wherever possible the concentrations of the elements were correlated with the sharks' species, sex and site of capture. (Deal-EIS)
W80-03285

COMBINED EFFECTS OF CADMIUM, COPPER AND LEAD ON DEVELOPING HERRING EGGS AND LARVAE,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
H. V. Westernhagen, V. Dethlefsen, and H. Rosenthal.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol 32, p 257-278, 1979. 11 Fig, 5 Tab, 23 Ref.

Descriptors: *Fish eggs, *Toxicity, *Heavy metals, *Cadmium, *Copper, *Lead, Larval growth stage, Embryonic growth stage, Herrings, Mortality, Absorption, Path of pollutants, *Bioaccumulation, *Tissue analysis.

Eggs of Baltic herring were incubated (10C; 16 o/oo S) in sea water containing mixtures of Cd, Cu and Pb at concentrations of 0.56 - 5.0, 0.0167 - 0.15, 0.56 - 5.0 mg metal/l. Embryonic survival until hatching, viable hatch and uptake of metals by embryos and early larvae were measured. Negative effects of metals on embryonic survival and viable hatch were additive in the case of Cu and Cd. Pb did not exert detrimental effects. Uptake of metals with exposure time was non-linear in eggs and linear in larvae. Total uptake of Cu and Cd by eggs was subjected to antagonistic or synergistic action of the other two metals present. Accumulation of Pb by eggs was enhanced when Cu was also present. (Deal-EIS)
W80-03286

MERCURY, DDE, AND PCBS IN EGGS FROM A NORWEGIAN GANNET COLONY,
Tromsoe Univ. (Norway).
N. Fimreite, N. Kveseth, and E. M. Brevik.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 142-144, 1980. 1 Tab, 14 Ref.

Descriptors: *Mercury, *Pesticide residues, *Bird eggs, DDE, Polychlorinated biphenyls, Heavy metals, Water birds, Pesticide kinetics, Path of pollutants, Gas chromatography, *Gannet, *Morus, *Tissue analysis.

The residues of mercury, DDE and PCBs in seabird eggs sampled in 1972 were compared to similar analyses in 1978. The average total mercury level increased from 0.58 to 0.80 ppm between 1972 and 1978. In contrast to mercury, the DDE and PCB levels decreased substantially in the same period, from 2.1 to 0.66 and from 7.7 to 3.5 ppm, respectively. The mercury was composed almost entirely of methylmercury. (Deal-EIS)
W80-03288

TOXIC EFFECTS OF THE PHYTOALKALOID COLCHICINE ON OVIPOSITION AND NEUROSECRETION OF THE VECTOR SNAIL (INDOPLANORBIS EXUSTUS),
Marathwada Univ., Aurangabad, (India). Dept. of Zoology.
M. M. Hanumante, D. P. Vaidya, and R. Nagabhushanam.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 37-39, 1980. 1 Tab, 7 Ref.

Descriptors: *Pesticide toxicity, *Gastropods, *Molluscicides, Animal parasites, Vectors(Biological), Trematodes, Worms, Mode of action, Reproduction, Inhibition, Fertility, Public health, *Colchicine.

Chemical control of freshwater gastropods that transmit trematode parasites is still the most promising method of curbing snail-borne diseases. This

study examines the effectiveness of colchicine in disrupting reproduction in the snail (Indoplanorbis exustus). At sublethal concentrations (10 ppm) colchicine had critical effects at both behavioral (oviposition) and cellular (neurosecretory) levels. Effects were also noted in the structure and number of eggs laid, significantly decreasing fertility. The specific cellular types and functions effected are also discussed. (Deal-EIS)
W80-03289

IDENTIFICATION OF CHLORDANES AND RELATED COMPOUNDS IN GOBY-FISH FROM TOKYO BAY,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
T. Miyazaki, K. Akiyama, S. Horii, and T. Yamagishi.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 1-8, 1980, 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Pollutant identification, *Pesticide residues, *Marine fish, Pesticide kinetics, *Chlorinated hydrocarbon pesticide, Heptachlor, Gas chromatography, Path of pollutants, Chemical properties, Bioindicators, *Nonachlor, *Chlordane, *Japan, *Goby-fish, *Tissue analysis.

We recently reported that trans-nonachlor had been identified in gaby-fish collected from Tokyo Bay. The detection of this compound in fauna suggested environmental pollution by chlordane and/or heptachlor, because trans-nonachlor is one of the constituents of technical chlordane and technical heptachlor. The goby-fish samples known have been intensively examined. Four unknown peaks were found in the fractions of organochlorine pesticides. The unknowns were identified as oxychlordane, trans and cis-chlordanes and cis-nonachlor by gas chromatography-mass spectrometry. These compounds have not been previously identified in environmental biota in Japan, while detected only in U.S.A. (Deal-EIS)
W80-03290

EFFECTS OF P,P'-DDT, P,P'-DDD, AND P,P'-DDE ON OXYGEN UPTAKE IN THE FRESHWATER PLANARIAN (PHAGOGATA GRACILIS),
Middle Tennessee State Univ., Murfreesboro.
B. H. Batey, and M. R. Wells.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 128-133, 1980. 4 Tab, 5 Ref.

Descriptors: *Pesticide toxicity, *Oxygen requirements, *Worms, *DDT, DDD, DDE, *Chlorinated hydrocarbon pesticides, Toxicity, Mode of action, Oxygen demand, Animal metabolism, Enzymes, Biodegradation, *Planarians, *Phagocata, *Bioaccumulation.

The toxicity of DDT and two of its metabolites (DDD and DDE), as measured by oxygen uptake, was studied in the freshwater planarian, Phagocata gracilis. The data presented indicate that 60-min exposure of P. gracilis to beef liver perfused with 10 ppm of p,p'-DDT, p,p'-DDD, or p,p'-DDE in corn oil was not toxic to this species. It is possible, therefore, that P. gracilis possessses a microsomal enzyme system capable of degrading DDT into DDD and DDE by reductive dechlorination and dehydrochlorination, respectively. It is also conceivable that P. gracilis failed to accumulate within 60 min sufficient amounts of DDT, DDD, or DDE to toxic effects. Longer exposure of P. gracilis to DDT and its metabolites could perhaps result in the buildup of dangerously toxic levels in its adipose tissue. (Deal-EIS)
W80-03291

A POSSIBLE PHYSIOLOGICAL UPTAKE MECHANISM OF METHYLMERCURY BY THE MARINE BLOODWORM (GLYCERA DIBRANCHIATA),
Illinois State Univ., Normal. Dept. of Biological Sciences.
D. M. Medeiros, L. L. Cadwell, and R. L. Preston.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 97-101, 1980. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Mercury, *Worms, *Absorption, Chemical properties, Chemical reactions, Path of pollutants, Heavy metals, Radiochemical analysis, Tracers, Membrane processes, Animal metabolism, *Depuration, *Tissue analysis, *Methylmercury.

The objective of this paper is to examine the uptake mechanism of methyl-mercury from water in a lower-food-chain organism, the marine bloodworm (Glycera dibranchiata). Whole bloodworms were exposed to 10 ppb 203Hg for 4 days and monitored at regular intervals by a scintillation detector. Elimination of 203Hg after a half-hour exposure was also studied. Initial uptake of mercury was extremely rapid (60 ppb within the first 10 h as compared to 80 ppb for 80 h.). Elimination was also extremely rapid in the initial phase. In a sea water medium the final (8h.) concentration was still 70% of original mercury content. In a cysteine medium the final mercury content was less than 20% of the original. Various mechanisms for membrane uptake of mercury are discussed. (Deal-EIS)
W80-03293

SELENIUM TOXICITY TO DAPHNIA MAGNA, HYALLELA AZTECA, AND THE FATHEAD MINNOW IN HARD WATER,
Michigan State Univ., East Lansing. Pesticide Research Center.
M. T. Halter, W. J. Adams, and H. E. Johnson.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 102-107, 1980. 1 Fig, 2 Tab, 23 Ref.

Descriptors: *Toxicity, *Metals, *Daphnia, *Minnows, Bioassay, Hardness(Water), Mortality, Lethal limit, Amphipoda, Animal physiology, Fish physiology, Fertility, *Selenium, *Hyallela fathead minnow.

This is a report on the comparative toxicity of selenium to three common representatives of the warm-water biota, Daphnia magna, Hyallela azteca, and the fathead minnow (Pimephales promelas). Selenium concentrations above about 0.5 mg/l were lethal to daphnia within 96h, but at lower concentrations toxicity declined sharply. H. azteca were killed by selenium levels above about 0.5 mg/l for 96h. Continued exposure at lower selenium concentrations produced additional mortalities. Mortalities of fathead minnow fry occurred at all selenium levels tested, from 0.35 to 1.4 mg/l Se. Daphnia was the most sensitive species initially but the least sensitive ultimately. Amphipods were the most sensitive species after 336h (two weeks) of exposure, but further effects apparently could be expected under continued exposure for both amphipods and fish. The threshold reaction time or induction period of selenium toxicity, as seen at higher selenium levels, for fish was at least double that measured for invertebrates. (Deal-EIS)
W80-03294

HEAVY METALS IN THE SEDIMENTS OF THE GULF OF BOTHNIA,
Stockholm Univ. (Sweden). Dept. of Geology.
R. O. Hallberg.
Ambio, Vol 8, No 6, p 265-269, 1979. 4 Fig, 6 Tab, 30 Ref.

Descriptors: *Heavy metals, *Sediments, *Path of pollutants, Industrial wastes, *Nickel, *Manganese, *Cobalt, *Molybdenum, *Cadmium, *Zinc, *Iron, *Copper, *Lead, *Mercury, Water chemistry, Water pollution sources, Bottom sediments, *Arsenic, *Vanadium.

The Baltic Sea has been severely contaminated with metals since the beginning of this century. This study reports on an examination of heavy metal sediment and tributary river chemistry in the northern part of the Baltic Sea--the Gulf of Bothnia. The Gulf was found to be highly polluted with heavy metals, especially arsenic, lead and mercury. Rivers constituted the primary pathways of metals to the Gulf. Because the metal content of the sediments does not correlate to the river loadings, this probably indicates that large amounts of metals are transported south to the Baltic proper. (Deal-EIS)
W80-03295

HYDROIDS IN BIOTEST: CLAVA MULTICORNIS EXPOSED TO CADMIUM,
Kiel Univ. (Germany, F.R.). Inst fuer Meereskunde.
H. Fischer.
Kieler Meeresforschungen, Vol 4, p 327-334, 1978. 2 Fig, 1 Tab, 27 Ref.

Descriptors: *Cadmium, *Toxicity, *Water temperature, Bioassay, Salinity, Predation, Animal behavior, Heavy metals, Mortality, Bioindicators, *Hydroids, *Clava, *Hydrozoa.

The influence of different temperatures and salinities on the toxicity of cadmium has been studied in short- and long-term experiments, using the colonial hydroid Clava multicornis as test organism. Clones were subcultured under prospective T/S-test conditions, applying 12 1 recirculating seawater systems with biological water conditioning, glass plates for substratum, and Artemia nauplii for food. The inability of C. multicornis to catch and swallow prey induced by heavy metals was chosen as lethal criterion. High temperature and low salinity within the ecological range of the species increased the acute toxicity of cadium, while low temperature and high salinity enabled C. multicornis to resist higher metal concentrations in the water or delayed the appearance of reactions on pollution, respectively. The long-term sublethal threshold concentration of some 200 microg Cd/l was not affected by combinations of temperature from 5 to 20C and salinity from 10 to 25 o/oo. (Deal-EIS)
W80-03296

TOXIC EFFECTS AND ACCUMULATION OF CADMIUM IN SOME BENTHIC ORGANISMS OF THE BALTIC,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
N. Scholz, H. Fischer, and H. Theede.
Kieler Meeresforschungen, Vol 4, p 317-326, 1978. 4 Fig, 24 Ref.

Descriptors: *Cadmium, *Toxicity, *Benthic fauna, Water temperature, Salinity, Mollusks, Mussels, Heavy metals, Animal physiology, Animal metabolism, Path of pollutants, Mode of action, Enzymes, Inhibition, Biochemistry, Proteins, *Hydrozoa, *Clavis, *Laomedea, *Tissue analysis, *Bioaccumulation, *Baltic Sea.

In coastal areas or estuaries cadmium content of water and sediments may be distinctly increased. The acute toxicity of Cd to sensitive organisms is strongly modified by environmental factor combinations occuring in the Baltic. In comparison with other species and developmental stages, up to the present, Laomedea loveni proved to be the most sensitive test species to Cd. Within the ecological range the sensitivity to Cd increases with higher temperatures and lower salinities. Under these conditions not only is the rate of accumulation of Cd enhanced, but the protoplasmic sensitivity is increased to internal metal concentration. In long-term experiments with Clava multicornis the modifying effect of temperature and salinity decreases during the course of some weeks. Contrary to cnidarians, many molluscs are able to accumulate high concentrations of Cd without signs of physiological damage. In many places in the Western Baltic the levels of Cd in Mytilus edulis are higher than in comparable individuals from localities on the North Sea coast. There are also correlations of Cd content of mussels with depth of their locality, size, and season. Of the mussel's organs, digestive diverticula and kidney greatly accumulate the metal. Preliminary results with ion exchange, and gel filtration chromatography of the mussel's proteins, suggest the occurence of special Cd-binding proteins, e.g. in the hepatopancreas, as a main reason for the high tolerance of M. edulis to cadmium. (Deal-EIS)
W80-03297

REVIEW OF EXPERIMENTS ON THE CHRONIC TOXICITY EXERTED BY SOME POLLUTANTS ON ANIMAL SPECIES FROM THE BAY OF GDANSK,
Akademia Medyczna, Gdansk (Poland). Dept. of

Biology.
F. Pautsch.
Kieler Meeresforschungen, Vol 4, p 335-359, 1978. 22 Fig, 2 Tab, 26 Ref.

Descriptors: *Toxicity, *Detergents, *Oil, *Phosphorus compounds, Fuels, Oil pollution, Surfactants, Fertilizers, Chemical wastes, Shrimp, Crabs, Carp, Pikes, Perches, Animal metabolism, Enzymes, Reproduction, Growth stages, Animal growth, Mode of action, *Crude oil, *Dispersants, *Phosphogypsum.

The subject of the experimental investigations is the effects of chronic toxicity exerted by the following pollutants of industrial origin on some animals from the Bay of Gdansk: (1) phosphogypsum; (2) some detergents, i.e. a commercial product 'So-LO', a mixture of nonionic and anionic surfactants (for household purposes), and an oil-spill remover Gamlen 'CW' Solvent; (3) crude Kuwait oil and one of its derivatives, fuel oil No. III. The experimental animals are: Crangon crangon L., Rhithropanopeus harrisi (Gould), the crucial carp (Carassius carassius L.), the pike (Esox lucius L.) and the perch (Perca fluviatilis L). The pollutants mentioned above induce sublethal changes in: the enzymic system; reproductive activity; and embryonic and larval development. Additionally, degenerative changes in the ultrastructure of crustacean brain and pathological disturbances in function and structure of isolated mitochondria could be observed. The general conclusion is that chronic sublethal toxicity may severely affect or even destroy some marine ecosystems. (Deal-EIS)
W80-03298

5B. Sources Of Pollution

ZINC IN THE CONWY RIVER AND ESTUARY,
Leeds Univ. (England). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2L.
W80-03029

THEORETICAL AND EXPERIMENTAL STUDY OF WIND- AND WAVE-INDUCED DRIFT,
Shell Development Co., Houston, TX.
D. T. Tsahalis.
Journal of Physical Oceanography, Vol 9, No 6, p 1243-1257, November 1979. 13 Fig, 5 Tab, 28 Ref.

Descriptors: *Aquatic drift, *Oil spills, *Laboratory tests, *Theoretical analysis, Model studies, Mathematical models, Winds, Velocity, Shear, Waves(Water), Pollutants, Water pollution, Path of pollutants, Oceans, Oceanography, Surface drift.

A study was carried out on the surface drift on open water due to the combined action of currents, winds, and wind-generated waves for cocurrent and countercurrent airflow. It was shown theoretically that the nondimensional groups necessary for the modeling of the surface drift are (T - c)/c and U sub 10/c, where U sub 10, T, and c are the wind, water surface, and current velocities, respectively, the wind being measured at the uniquely adopted height of 10 m. Surface drift experiments, carried out in a current tank/wind tunnel, verified the dependence on the above groups and led to the derivation of relationships for the calculation of the total surface drift. The surface drifts, calculated from the above relationships, were in excellent agreement with available field and laboratory data. These results supported Charnock's expression relating the surface roughness and shear velocity for completely rough flow due to gravity waves and Wu's Froude number scaling of wind-stress coefficients. Furthermore, these results showed that wind-generated waves generally cause a net decrease or increase of the surface drift for cocurrent and countercurrent airflow, respectively. Finally, laws were formulated for the scaling of current tank/wind tunnel data for wind velocities and significant wave heights to prototype (atmospheric boundary layer) conditions. (Sims-ISWS)
W80-03031

THE IMPACTS OF COAL STRIP MINING ON THE HYDROGEOLOGIC SYSTEM OF THE NORTHERN GREAT PLAINS: CASE STUDY OF POTENTIAL IMPACTS ON THE NORTHERN CHEYENNE RESERVATION,
Nevada Univ. System, Las Vegas. Water Resources Center.
W. W. Woessner, C. B. Andrews, and T. J. Osborne.
Journal of Hydrology, Vol 43, No 1/4, p 445-467, October 1979. 7 Fig, 3 Tab, 44 Ref, EPA R803566.

Descriptors: *Strip mines, *Groundwater, *Effects, *Great Plains, *Montana, Mining, Coal mines, Water quality, Dissolved solids, Aquifers, Geology, Hydrogeology, On-site investigations, Model studies, Mathematical models, Water pollution sources, Hydrology, Strip mining impacts.

Fifty percent of the coal production of the U.S. will be obtained from the western coal fields by 1990. The majority of this coal will be produced from large-scale strip mining of the Tertiary Fort Union and Wasatch Formations of Wyoming, Montana, and North Dakota. The rapid escalation of coal strip-mining activities in the Northern Great Plains, where groundwater is the principal source of domestic and agricultural supply, threatens to alter significantly the local and regional hydrologic regime. A study of the potential impacts of strip mining on their water resources was designed and implemented. After a basic hydrogeologic study was conducted, a hypothetical mine study site was selected for evaluation. The premining hydrologic system was defined from a monitoring well network, aquifer testing, water-quality sampling, and stream gaging. Saturation extract and leachate analyses were conducted on cuttings of overburden from wells in the mine area, and results were used to predict the concentration of total dissolved solids (TDS) in spoil-water discharge. Strip mining of the entire minable area would have a major impact on the regional groundwater quality and a measurable impact on the quality of the receiving stream. Analysis of projected hydrologic properties of the post-mining system indicated that water-quality impacts will last for hundreds of years. (Sims-ISWS)
W80-03042

THE VOLUME-AVERAGED MASS-TRANSPORT EQUATION FOR CHEMICAL DIAGENETIC MODELS,
Illinois Univ. at Urbana-Champaign. Dept. of Geology.
P. A. Domenico, and V. V. Palciauskas.
Journal of Hydrology, Vol 43, No 1/4, p 427-438, October 1979. 1 Fig, 18 Ref.

Descriptors: *Mass transfer, *Diagenesis, *Chemicals, *Equations, *Model studies, Mathematical models, Groundwater, Groundwater movement, Pores, Pollutants, Path of pollutants, Adsorption, Solutes, Porous media, Soil water.

The mass-transfer equation as appropriate for chemical diagenesis problems was developed from the viewpoint of a divergence theorem. Specific features of the averaged equations included some well-known results, such as the structure of a diffusion coefficient in a porous sediment and the emergence of dispersion as a dominant mixing phenomenon. Other results reflected the inclusion for provisions for an upper moving boundary for accumulating sediments and a suggested structure for heterogeneous reactions at phase interfaces. Specific forms for the fluxes at interfaces were determined on the basis of conceptual models of the reaction process. (Sims-ISWS)
W80-03044

TIME-DEPENDENT SORPTION ON GEOLOGICAL MATERIALS,
Nevada Univ. System, Reno. Water Resources Center.
P. R. Fenske.
Journal of Hydrology, Vol 43, No 1-4, p 415-425, October 1979. 3 Fig, 3 Tab, 4 Ref.

Descriptors: *Sorption, *Radioisotopes, *Rocks, *Laboratory tests, Cesium, Groundwater, Aquifers, Groundwater movement, Equilibrium, Velocity, Water quality, Pollutants, Path of pollutants, Gravels, Water pollution, Time-dependent sorption, Geological materials.

The transport of radionuclides through geologic materials has been predicted using the assumption that sorption on rocks along the transport path occurs instantaneously. This assumption is valid if equilibrium sorption is reached rapidly relative to groundwater velocity. Laboratory experiments with large pieces of rock and also varying particle sizes indicate that equilibrium sorption may be reached too slowly under some conditions for the assumption of instantaneous sorption to be valid. An empirical equation has been devised from the laboratory experiments to describe the time-dependent sorption process for 137Cs on breccia and andesite. The hypothetical example was then worked out for flow through granular materials (pebble and cobble size) and flow through fractured rocks considering a time-dependent sorption. Dispersion was not considered in this analysis. The hypothetical prediction showed that for usual groundwater velocities, transport considering time-dependent sorption is not significantly greater than transport assuming equilibrium sorption. At velocities of groundwater above 0.5 cm/hr (1 ft/hr) the effect of the time-dependent sorption term can easily be seen in the analysis. The analysis also showed that sorption during transport through granular (pebble and cobble size) materials is less, with less retardation, than sorption during transport through fractured rocks. This is because the mass of rock/volume of water ratio is far greater in fractured materials than in granular materials. Consideration of time-dependent sorption will probably not increase predictive capability for radionuclide transport. (Sims-ISWS)
W80-03045

DEMONSTRATION OF NONPOINT POLLUTION ABATEMENT THROUGH IMPROVED STREET CLEANING PRACTICES,
Woodward-Clyde Consultants, San Francisco, CA.
R. Pitt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108988, Price codes: A13 in paper copy, A01 in microfiche. Report No EPA-600/2-79-161, August 1979, 289 p, 96 Fig, 114 Tab, 57 Ref, 7 Append. S-804432.

Descriptors: *Urban runoff, *Dusts, *Pollution abatement, *Water pollution control, Water quality, Particle size, Cost-benefit analysis, Air pollution, Paving, Cost analysis, Waste water treatment, Storm drains, California, Street cleaning.

The role of street dirt in water and air pollution, and methods of reducing this source of pollution, are described. Sampling procedures to test street cleaning equipment performance were developed and used to determine the range of capabilities of current street cleaning equipment and to gain general information about the cost and effectiveness of various street cleaning programs. Accumulation rates for street surface particulates were measured between each street cleaner test in San JOse, California. Overall, as particle size of pollutants decrease, concentrations increase. Also, most street cleaning equipment is more effective at removing large particles than small. Equipment tests showed that test area differences are more important to performance than differences in equipment. Types of equipment tested were: four-wheel mechanical street cleaners, state-of-the-art mechanical four-wheel street cleaners, and vacuum-assisted street cleaners. Smooth asphalt streets are easier to maintain in clean state than rough streets. Pollutant mass flow characteristics of urban runoff were also studied to estimate the beneficial effects of street cleaning and to compare the quality of urban runoff with sanitary waste water effluent quality. Cost and labor analyses were included for street cleaning, runoff treatment, and combined runoff and waste water treatment. Results of a study on air pollution from street dirt are also presented. (Seigler-IPA)
W80-03098

ASSESSING IMPACTS OF LAND MANAGEMENT ACTIVITIES ON EROSION-RELATED NONPOINT SOURCE PROBLEMS,
Oregon State Dept. of Environmental Quality, Portland.
D. A. Rickert, and G. L. Beach.
Journal of Water Pollution Control Federation, Vol 50, No 11, p 2439-2445, 1978. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Oregon, *Stream erosion, *Nonpoint pollution, *Land management, Erosion, Water quality, Maps, Land use, Sedimentation, Watersheds(Basins), Surveys, Environmental effects, Management, Soil erosion, Land resources, Land, Environment, Forestry, Grazing, Agriculture.

This paper deals with Phase II of Oregon's Section 208 water quality planning process, a detailed basin assessment project aimed at relating stream quality to both natural terrain characteristics and to land management activities within forestry, grazing, and agriculture. Its goal is to determine relative erosion potential and most suitable management activities for different terrains. The assessment emphasizes erosion and sedimentation because these are the most widespread and pervasive non-point pollution problems in Oregon. Instead of collecting water quality data, the project determines stream quality through reconnaissance field surveys of channel stability and fishery habitat conditions. In contrast to water quality parameters, these stream characteristics are more permanent. Maps and matrices show areas where erosional and depositional problems are most prevalent. In addition, plant nutrients, pesticides, and trace metals tend to move into streams due to attachment to sediment particles. By using erosion potential maps and impact matrices, data programs can be spatially designed to better define cause-and-effect relationships of land and water quality. As developed, the procedure can be used to determine suitability of land management activities, monitor the success of land management regulations, and set priorities for site-specific studies of land management activities. (Danovich-Wisconsin)
W80-03113

DEPOSITION VELOCITY OF PHOSPHORUS-CONTAINING PARTICLES OVER SOUTHERN LAKE HURON, APRIL-OCTOBER, 1975,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
R. Delumyea, and R. L. Petel.
Atmospheric Environment, Vol 13, No 2, p 287-294, 1979. 8 Fig, 3 Tab, 18 Ref.

Descriptors: *Lake Huron, *Phosphorus, *Deposition(Sediments), *Velocity, *Mathematical models, Aerosols, Fallout, Particle size, Dusts, Model studies, Limiting factors, Mixing, Winds, Erosion, Wind erosion, Aeolian soils, Wind velocity, Atmosphere, Air circulation.

Based on samples from Lake Huron and 11 land stations collected April-October 1975, a 0.57 cm/sec deposition velocity for phosphorus-containing particles was calculated using a mixing box model. Phosphorus is the limiting nutrient in the Great Lakes region. Dry deposition represents an important input mechanism since all material entering the lake by this method must pass through the euphotic zone and dry deposition is a continuous process. Particle mass median diameter is 1 micro m with 10% less than 0.1 micro m in size; the most significant fraction is due to continental erosion. The ratio of downwind to upwind phosphorus contents of aerosol, C/Co, ranges 0.4-0.8; this ratio increases with increasing wind speed. The C/Co is independent of concentration which ranges 13.4-33.2 micro g/cu m. The faster the wind blows, the smaller the aerosol residence times over the lake. The C/Co values were used to calculate deposition velocities for each period using a simple box model. Assumptions include: (1) constant mixing height; (2) complete sink at the bottom; (3) complete content mixing; (4) no aerosol sources in the box; (5) constant deposition velocity; and (6) wind direction knowledge. Calculated deposition velocity, 0.57 cm/sec is higher than wind tunnel data but is consistent with other field experiments. (Danovich-Wisconsin)
W80-03117

BENTHIC INVERTEBRATES, PERIPHYTON, AND BOTTOM MATERIAL AND THEIR TRACE-METAL CONCENTRATIONS IN SALMON CREEK BASIN, CLARK COUNTY, WASHINGTON,
Geological Survey, Portland, OR. Water Resources Div.
A. C. White, and S. W. McKenzie.
Geological Survey open-file report 79-978, 1979. 18 p, 1 Fig, 8 Tab, 20 Ref, Append.

Descriptors: *Trace elements, *Environmental effects, *Aquatic animals, *Water analysis, *Benthos, Bottom sediments, Benthic fauna, Invertebrates, Chemical analysis, Heavy metals, Physical properties, Periphyton, Evaluation, *Salmon Creek basin(WA).

In 1978, data were collected for identification and quantification of benthic invertebrates, periphyton, and bottom material and their trace-metals concentrations from three sites in Salmon Creek basin, Wash. Metal analyses included arsenic, cadmium, chromium, copper, lead, zinc, selenium, and mercury. Physical data collected included water temperature, dissolved oxygen, pH, discharge, and size of cobbles and fine stream-bottom material. Additional chemical analyses included major constituents. Benthic invertebrate identifications were generally taken to the generic level, with a total of 49 taxons identified and quantified. A total of 36 periphyton taxons were quantified and identified, generally at the species level. (Woodard-USGS)
W80-03162

WATER-QUALITY CONDITIONS IN THE NEW RIVER, IMPERIAL COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. G. Setmire.
Geological Survey Water-Resources Investigations 79-86, July 1979. 63 p, 17 Fig, 12 Tab, 15 Ref.

Descriptors: *Water pollution sources, *Organic wastes, *Water quality, *Mexico, *California, Streams, Water analysis, Dissolved oxygen, Chemical oxygen demand, Turbidity, Carbon, Evaluation, *International streamflow, *Mexico-California boundary, *New River(Calif), *Imperial County(Calif).

The New River, when entering the United States at Calexico, Calif., often contains materials which have the appearance of industrial and domestic wastes. Passage of some of these materials is recognized by a sudden increase in turbidity over background levels and the presence of white particulate matter. Water samples taken during these events are usually extremely high in organic content. During a 4-day reconnaissance of water quality in May 1977, white-to-brown extremely turbid water crossed the border on three occasions. On one of these occasions, the water was intensively sampled. The total organic-carbon concentration ranged from 80 to 161 milligrams per liter (mg/l); dissolved organic carbon ranged from 34 to 42 mg/l, and the chemical oxygen demand was as high as 510 mg/l. River profiles showed a dissolved-oxygen sag, with the length of the zone of depressed dissolved-oxygen concentrations varying seasonally. During the summer months, dissolved-oxygen concentrations in the river were lower and the zone of depressed dissolved-oxygen concentrations was longer. The largest increases in dissolved-oxygen concentration from reaeration occurred at the three drop structures and the rock weir near Seeley. The effects of oxygen demanding materials crossing the border extended as far as Highway 80, 19.5 miles downstream from the international boundary at Calexico. Fish kills and anaerobic conditions were also detected as far as Highway 80. Standard bacteria indicator tests for fecal contamination showed a very high health-hazard potential near the border. (Woodard-USGS)
W80-03164

IMPORTANCE OF A BORDERING WETLAND FOR CHEMICAL PROPERTIES OF LAKE WATER,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
A. Kowalczewski.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2182-2185, 1978. 7 Ref. OWRT A-054-CONN(8).

Descriptors: *Chemical properties, *Swamps, *Durham Pond(CT), *Nutrient transport, *Decomposing organic matter, Water properties, Hydrogen ion concentration, Lakes, Wetlands, Water quality, Carbon dioxide, Groundwater, Dissolved solids, Organic matter, Color, Conductivity, Degradation(Decomposition), Nutrients, Groundwater movement, Waste assimilative capacity.

Studies of Dunham Pond, Connecticut, a typical New England red maple-Sphagnum swamp with shrub understory and limited herb cover, show that wetlands do not act as important sinks for nutrients; however, they do accumulate dissolved colored organic substances. The first sampling station was located in a spring, middle stations in the swamp, and the last station in lake littoral areas. Water status at the last site before entering the lake reflects the sum of swamp ecosystem metabolism influences. Water after passing through the swamp is not significantly changed with respect to pH, conductivity, and carbon dioxide. Spring pH values vary 5.25-7.0; pH decreases through the swamp; closer to the lake, pH increases again. Carbon dioxide changes are similar to pH changes. After an initial drop, carbon dioxide continues to build up in the stream; carbon dioxide concentrations stay relatively high until reaching the lake. Electrical conductivity of groundwater at station 1 is relatively constant. It decreases at upper stations 2-3, then increases again in lower stream areas. High conductivity values indicate nutrient accumulation. Spring water is practically colorless; during movement through the swamp, average OD increases 3000 times. DOC content in groundwater is relatively low during the year and rarely exceeds 5 mg C/l; however, DOC increases downstream. DOC shows seasonal variations; it is high in November-December and low in January-April when swamp decomposition is also low. (Danovich-Wisconsin)
W80-03169

BIOCHEMICAL SIGNIFICANCE OF ARSENICAL POLLUTANTS IN A POTABLE WATER SUPPLY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W80-03175

SIMULATING NUTRIENT MOVEMENT AND TRANSFORMATIONS WITH THE ARM MODEL,
Hydrocomp, Inc., Mountain View, CA.
H. H. Davis, Jr., and A. S. Dinigian, Jr.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1081-1086, September-October 1979. 9 Fig, 1 Tab, 12 Ref.

Descriptors: *Nutrients, *Water pollution, *Runoff, *Agricultural runoff, *Model studies, Mathematical models, Nitrogen, Nitrates, Nitrites, Phosphorus, Phosphorus compounds, Agricultural chemicals, Fertilizers, Pollutants, Path of pollutants, Solutes, Sediments, Rainfall, Storms, Simulation analysis.

The plant nutrient section of the Agricultural Runoff Management (ARM) Model was developed for the EPA as a tool for predicting the amounts of plant nutrients (N and P) removed from agricultural lands by precipitation-induced runoff and erosion. First-order kinetics were used to model the transformations, plant uptake, and sorption of soil nitrogen and phosphorus. The influence of soil temperatures on the first-order rates was calculated with a modified Arrhenius equation. Initial testing was performed with data from two small (less than 1.5 ha) watersheds in Michigan and Georgia. Initial results showed that the model was able to repre-

sent soil nutrient data reasonably well. Monthly simulation results of N and P in the runoff were satisfactory; however, storm event simulation of soluble nutrients indicated further study of solution-based transport is needed. (Sims-ISWS)
W80-03180

SIMULATION OF NITROGEN AND PHOSPHORUS LEACHING FROM POULTRY MANURE,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
R. E. Muck, and D. C. Ludington.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1087-1092, September-October 1979. 6 Fig, 3 Tab, 26 Ref.

Descriptors: *Model studies, *Leaching, *Water pollution sources, *Farm wastes, Laboratory tests, Testing procedures, Mathematical models, Simulation analysis, Porous media, Nutrients, Nitrogen, Phosphorus, Theoretical analysis, Instrumentation.

A model based on simple diffusion was developed to describe the leaching of soluble nitrogen and phosphorus from dry poultry manure aggregates. The leaching losses of ammonia and organic nitrogen measured in laboratory experiments were successfully predicted with the model. Soluble orthophosphate losses were predicted with less success. These predictions could possibly be improved by considering phosphorus solubility. The model was not as successful, however, in predicting soluble nutrient losses from aggregates undergoing breakdown from rainfall impact. Consequently, for the model to be useful on the field level, this model must be combined with models predicting changes in manure aggregate size and other field phenomena. (Humphreys-ISWS)
W80-03181

TILLAGE SYSTEM EFFECTS ON SEDIMENT AND NUTRIENTS IN RUNOFF FROM SMALL WATERSHEDS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
H. P. Johnson, J. L. Baker, W. D. Shrader, and J. M. Laflen.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1110-114, September-October 1979. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Runoff, *Sediments, *Nutrients, *Agricultural watersheds, Farm management, On-site investigations, Sampling, Pollutants, Water pollution, Phosphorus, Nitrogen, Erosion, Corn(Field), Water pollution sources, Path of pollutants, Hydrology, Tillage practices, Crop residues.

Two conservation tillage systems were studied and compared with the conventional (plow-disk-plant) tillage system. Runoff, soil loss, and nutrient losses during the 1973-75 growing seasons were measured for six small, paired watersheds planted to continuous corn (runoff and soil loss for the year 1972, when conservation tillage systems were being established, were also measured). Fifty-nine percent of the soil surface under ridge-planting and 11% under till-planting were covered with crop residue, compared to less than 2% for conventional planting. Conservation tillage systems on the average reduced runoff about 40% and reduced soil loss from 60 to 90%. Total losses of nitrogen and phosphorus (total P in sediment measured only in 1973) were mostly associated with soil loss and consequently were decreased for conservation tillage systems. Solution phosphorus losses and concentrations and available P concentrations in sediment (measured in 1974 and 1975) increased with residue cover. Several factors could be responsible, including decreased fertilizer incorporation, selective erosion processes, and the residue being a phosphorus source. Corn yield data were given. (Sims-ISWS)
W80-03183

NUTRIENT LOADS IN STREAMFLOW FROM SANDY SOILS IN FLORIDA,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
K. L. Campbell.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1115-1120, September-October 1979. 8 Fig, 8 Tab, 12 Ref.

Descriptors: *Streamflow, *Nutrients, *Agricultural watersheds, *Land use, *Florida, Fertilizers, Precipitation(Atmospheric), Rainfall, Runoff, Agricultural runoff, Soils, Pollutants, Nitrates, Ammonia, Phosphorus, Phosphorus compounds, Watersheds(Basins), Hydrology, Path of pollutants, Water pollution, Water pollution sources.

Two agricultural watersheds with different land uses were instrumented to determine water quantity and quality measurements. Nitrogen and phosphorus loads in streamflow were about proportional to the flow volume. Nutrient losses in streamflow were very small when compared with the other components of nutrient balances in the two observed watersheds. Nitrogen and phosphorus losses in runoff were equivalent to about 5% of the commercial fertilizer applied and were less than the amounts received by the land area in precipitation. (Sims-ISWS)
W80-03184

OXYGEN DEFICIT--PHOSPHORUS LOADING RELATION IN LAKES,
Washington Univ., Seattle.
E. B. Welch, and M. A. Perkins.
Journal of the Water Pollution Control Federation, Vol 51, No 12, p 2823-2828, December 1979. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Dissolved oxygen, *Phosphorus, *Lakes, *Eutrophication, Hypolimnion, Model studies, Mathematical models, Oxygen, Oxygen demand, Water quality, Water pollution, Pollutants, Path of pollutants, Chemicals, Limnology, Oxygen depletion, Phosphorus loading.

Oxygen deficit rate in 26 lakes was found to be positively correlated with phosphorus loading normalized for flushing rate with an r of 0.73. The limit for eutrophic waters of 550 mg O2/sq m per day proposed by Mortimer has considerable merit if the regression equation found here is applied to Vollenweider's critical limit for annual, areal P loading = 200(Z sub rho) to the 0.5 power. The predicted oxygen deficit from that loading would result in stressful oxygen levels for hypolimnion-seeking fish during late summer. (Sims-ISWS)
W80-03185

IMPACT OF DEVELOPMENT ON WATERSHED HYDROLOGIC AND NUTRIENT BUDGETS,
Wisconsin Univ.-Madison. Center for Biotic Systems.
V. J. Watson, O. L. Loucks, J. Mitchell, and N. L. Clesceri.
Journal of the Water Pollution Control Federation, Vol 51, No 12, p 2876-2885, December 1979. 2 Fig, 4 Tab, 28 Ref. NSF DEB76-11776, DEB76-12294.

Descriptors: *Nutrients, *Lakes, *Nitrogen, *Phosphorus, Runoff, Chemicals, Pollutants, Eutrophication, Urbanization, Land development, Drainage, Watersheds(Basins), Hydrology, Limnology, *Lake George(NY), *Lake Wingra(WI).

This study assessed the impact of development on the hydrologic and nutrient budgets of contrasting watershed systems. Nutrient yields from the watersheds of oligotrophic Lake George (New York) and eutrophic Lake Wingra (Wisconsin) were estimated from measured nutrient concentrations and hydrologic flows and from hydrologic budget computations and were compared to reconstructed presettlement yields. Development-induced changes within the watersheds have altered phosphorus budgets more than nitrogen budgets, but the greatest impact on the Lake George budget comes from nitrogen-enriched precipitation. The Lake Wingra watershed appears to have been most affected by the alteration of its hydrology and morphology. (Sims-ISWS)
W80-03186

RELATIONSHIPS BETWEEN STREAM DISCHARGE AND YIELD OF DISSOLVED SUBSTANCES FROM A COLORADO MOUNTAIN WATERSHED,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
W. M. Lewis, Jr., and M. C. Grant.
Soil Science, Vol 128, No 6, p 353-363, December 1979. 4 Fig, 1 Tab, 33 Ref.

Descriptors: *Discharge(Water), *Chemicals, *Watersheds(Divides), *Mountains, *Colorado, Sampling, Chemical analysis, Data processing, Streamflow, Ions, Cations, Nitrogen, Nitrogen compounds, Phosphorus, Carbon, Sodium, Nutrients, Magnesium, Calcium, Runoff, Path of pollutants, Water pollution sources.

The dependence of concentration and yield of dissolved substances on water discharge was studied over a 150-week period in the watershed of Como Creek, Colorado, near the Continental Divide. Substances were divided into three groups on the basis of relationship between concentration and discharge: (1) substances whose concentrations decrease with increasing discharge (HC03(-), N03(-), Ca(2+), Mg(2+), Na(+)); (2) substances whose concentrations show no trend with discharge (NH4(+), dissolved organic phosphorus and nitrogen, K(+), S04(2-)); (3) substances whose concentrations increase with increasing discharge (dissolved organic carbon, H(+), P04(3-)). The concentration-discharge relationships were compared between years and generally showed evidence of a common slope between years, even though discharge and weather varied considerably between years. Mean concentrations between years were compared statistically at a common discharge and showed no significant differences between years, suggesting common control mechanisms between years for a given substance. Substances were also compared with respect to yield (product of concentration and discharge). Three categories of yield response to increasing discharge were identified. All showed increasing yield with increasing discharge but with: (1) yield increasing slower than discharge (HC03(-), N03(-), Ca(2+), Mg(2+), Na(+)); (2) yield increasing at the same rate as discharge (NH4(+), DON); (3) yield increasing faster than discharge (DOP, K(+), S04(2-), DOC, H(+), P04(3-)). Simple groundwater-precipitation mixing models are not adequate to explain these differences in concentration and yield responses to discharge. A satisfying mechanism to explain the differences between responses of dissolved substances to discharge must take into account not only mixing but also the chemical reaction of incoming precipitation with soil and soil water and the intensity of biological demands for the substances. (Sims-ISWS)
W80-03191

A MODEL FOR EVALUATING RUNOFF-QUALITY IN METROPOLITAN MASTER PLANNING,
Water Resources Engineers Inc., Walnut Creek, CA.
L. A. Roesner, H. M. Nichandros, R. P. Shubinski, A. D. Feldman, and J. W. Abbott.
Hydrologic Engineering Center, Technical Paper No 58, April 1974. 80 p, 25 Fig, 19 Tab, 13 Ref.

Descriptors: *Urban runoff, *Water quality, *Model studies, *Cities, *Planning, Watersheds(Basins), Runoff, Storm runoff, Hydrology, Runoff coefficient, Depression storage, Water pollution sources, Storm drains, Roads, Discharge(Water), Biochemical oxygen demand, Combined sewers, Water pollution, Pollutants, Nitrogen, Chemical oxygen demand, Data collections, Rainfall, Overflow, Infiltration rates, Catch basins.

The purpose of this document was to present an analytical method that can be used in the preliminary planning stage in the development of a pollution control program. The method has been coded into a computer program called STORM (Storage, Treatment, Overflow, and Runoff Model). This program represents a method of analysis to estimate the quantity and quality of runoff from small, primarily urban, watersheds. Nonurban areas may

also be considered. Land surface erosion for urban and nonurban areas is computed in addition to the basic water quality parameters of suspended and settleable solids, biochemical oxygen demand, total nitrogen, and orthophosphate. The purpose of the analysis is to aid in the selection of storage and treatment facilities to control the quantity and quality of urban stormwater runoff and land surface erosion. The model considers the interaction of eight variables: (1) precipitation, (2) air temperature for snowpack accumulation and snowmelt, (3) runoff, (4) pollutant accumulation on the land surface, (5) land surface erosion, (6) treatment rates, (7) storage, and (8) overflows from the storage/treatment system. Items (3), (4), and (5) are related to land use. Land uses accounted for in the model include: single family residential, multiple family residential, commercial, industrial, parks, and nonurban or undeveloped areas. The program is designed for use with many years of continuous hourly precipitation records. It is a continuous simulation model but may be used for selected single events. This program is available for the IBM 360/50, UNIVAC 1108, and CDC 6600 or 7600 computer systems. It requires about 35,000 words of core storage and a FORTRAN IV compiler that accepts multiple ENTRY statements. (Humphreys-ISWS)
W80-03199

EFFECTS OF ABRUPT CHANGE IN WATER QUALITY ON RAINBOW TROUT (SALMO GAIRDNERI RICH.),
Genoa Univ. (Italy). Inst. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03210

EUTROPHICATION, MINUTE ALGAE AND INEFFICIENT GRAZERS,
Oslo Univ. (Norway). Inst. of Zoology.
J. P. Nilssen.
Memorie dell'Istituto Italiano di Idrobiologia, Vol 36, p 121-138, 1978. 3 Fig, 101 Ref.

Descriptors: *Trophic level, *Nutrients, *Aquatic algae, *Lakes, Productivity, Herbivores, Predation, Eutrophication, Oligotrophy, Phosphorus, Copepods, Invertebrates, Nannoplankton, Cyanophyta, Phytoplankton.

The processes leading from an oligotrophic to a eutrophic state and the reverse are not simple functions of P-loadings. A number of stabilizing and de-stabilizing factors are put into action during these processes. One of the most significant of these includes changes in the grazer community due to increased size-selective predation from both fish and invertebrate predators, mainly cyclopoid copepods. This results in decreased control of nannoplankton outbursts, with subsequent nutrient depletion and low water transparency. These conditions are favourable for BG algal growth. A rapid way to restore the lake would probably be to decrease predation pressure on large filter feeders. Simultaneously the external loadings must be decreased. (Deal-EIS)
W80-03211

A STUDY OF THE DISTRIBUTION OF MERCURY IN THE VARIOUS COMPARTMENTS OF THE NORTH SEA AND SCHELDT ESTUARY ECOSYSTEMS,
Beheerseenheid Model Noordzee en Schelde Brussel, (Belgium).
For primary bibliographic entry see Field 5A.
W80-03213

ECOLOGICAL EFFECTS OF DISPERSANTS IN THE UNITED KINGDOM,
Society of Petroleum Industry Biologists, Los Angeles, CA.
E. B. Cowell.
In: Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L. T. McCarthy, Jr., G. P. Lindblom and H. F. Walter, Eds., American Society for Testing and Materials, p 277-292, 1978. 4 Fig, 4 Tab, 36 Ref.

Descriptors: *Toxicity, *Bioassay, *Oil spills, Oil, Organic compounds, Environmental effects, Aquatic life, Water pollution control, Shrimp, Crab, Clams, Mortality, Seasonal, Coasts, Surfactants, *Dispersants, *Oil dispersants.

The problems associated with the toxicity of dispersants at the time of the Torrey Canyon disaster are described together with subsequent developments to reduce toxicity. The problems of laboratory bioassay and its limitations in ecological prediction are reviewed in relation to dispersant concentrations that are reached under field use. Problems of the use and ecological effects of dispersants in shore cleaning are described in association with practical aspects of safe application and limitations. The author concludes that modern dispersant formulations can be used with minimum ecological risk provided the application is done with care by trained operators. It is stressed that even the most recently developed materials should not be used on areas of vascular plants such as salt marshes and mangroves. The lack of adequate research precludes recommending dispersants to treat oil spillage in freshwater rivers and lakes unless the bodies of water are extremely large. (Deal-EIS)
W80-03218

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN THE SEDIMENTATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN DABOB BAY, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-03220

EFFECT OF ENVIRONMENTAL SALINITY OF HAEMOLYMPH AND TISSUES OF MUSSELS,
Akademiya Nauk SSSR, Leningrad. Lab. of Comparative Biochemistry of Inorganic Ions.
For primary bibliographic entry see Field 5A.
W80-03222

EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON CARBOHYDRATE METABOLISM OF THE LIVER OF TWO BLACK SEA SPECIES OF FISHES,
Akademiya Nauk SSSR, Leningrad. Inst. Evolyutsionnoi Fiziologii i Bokhimii.
G. I. Kovaleva.
The Soviet Journal of Marine Biology, Vol 5, p 48-52, 1979. 4 Tab, 15 Ref.

Descriptors: *Oil, *Toxicity, *Fish physiology, Animal metabolism, Biochemistry, Carbohydrates, Mode of action, Cytological studies, Animal pathology, Chemical reactions, *Tissue analysis, *Liver, *Glucose, *Solea, *Spicara.

Glucose production by isolated sections of the liver of picarel (Spicara smaris L.) and Black Sea sole (Solea lascaris nasuta Pallas) during poisoning by dissolved petroleum is studied. It is shown that in vitro petroleum in a concentration of 1.8 and 3.0 microg/ml increases the production of glucose by the liver sections. Poisoning of fishes in vivo reveals hyperglycemia, a reduction in the content of glycogen in the liver, and also a decrease in the production of glucose by the isolated liver sections. The possible causes of these phenomena are discussed. The author assumes there is active detoxification of carbohydrates of petroleum in the liver which is accompanied by losses of energy resources and consumption of glucose. (Deal-EIS)
W80-03223

MONITORING OF CHLORINATED HYDROCARBONS IN BIOTA OF THE NORTH AND MIDDLE ADRIATIC COASTAL WATERS,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
B. Nazansky, N. Picer, M. Picer, and M. Ahel.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 129-132, 1979. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Pesticide residues, *Aquatic life, *Monitoring, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Mussels, Marine fish, Plankton, Chemical analysis, Water pollution sources, Industrial wastes, *Adriatic Sea, *Tissue analysis, River Po.

Since 1974 about 200 biota samples (mussel, Mytilus galloprovincialis, various benthic fishes and net plankton) covering areas of Istrian coastal waters, Rijeka Bay, Losinj, and coastal waters near the town of Zadar, have been analysed. Results (total DDT and PCBs concentrations) are given as geometrical means and discussed according to the investigated areas and biota species. The possible influences of local pollution sources and the inflow of the river Po and its effluents are discussed. (Deal-EIS)
W80-03226

LEVELS OF METAL POLLUTANTS IN SEDIMENTS AND BIOTA OF THE GULF OF TRIESTE: A LONG TERM SURVEY,
Trieste Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-03228

TRACE ELEMENTS IN PELAGIC ORGANISMS AND A PELAGIC FOODCHAIN OF THE AEGEAN SEA,
Democritus Nuclear Research Center, Athens (Greece). Radioanalytical Lab.
For primary bibliographic entry see Field 5A.
W80-03229

POLLUTION MONITORING OF ELEVEN TRACE ELEMENTS IN THREE MARINE ORGANISMS FROM SARONIKOS GULF, GREECE,
Democritus Nuclear Research Center, Athens (Greece). Radioanalytical Lab.
For primary bibliographic entry see Field 5A.
W80-03230

TRACE METALS AND ORGANOCHLORINE RESIDUE CONTENT OF MULLIDAE FAMILY FISHES AND SEDIMENTS IN THE VICINITY OF ERDEMLI (ICEL), TURKEY,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W80-03231

THE IMPACTS OF WASTES FROM A PHOSPHATE PLANT ON THE MARINE ENVIRONMENT (GULF OF GABES, TUNIS) (IN FRENCH),
Institut National Scientifique et Technique d'Oceanographie et de Peche, Tunis (Tunisia). Lab. de Biologie Marine.
B. Darmoul, P. Vitiello, and M. H. A. Salem.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 343-345, 1979. 1 Fig, 3 Ref.

Descriptors: *Water pollution effects, *Benthos, Industrial wastes, *Phosphates, Sediments, Silting, *Eutrophication, Acidic water, Mediterranean, Tunis, Gulf of Gabes, Environmental effects, Molluscs.

The discharge in the sea of phosphate industrial waste has caused several perturbations: increase of sea water turbidity and of siltation, overmuch enrichment of environment in phosphate and fluor, acidification of beach area's water, degradation of Posidonia meadow and the complete destruction of benthic community in an important area adjacent to the waste discharge. (Katz-EIS)
W80-03232

DISTRIBUTION AND IMPACT OF ANIONIC DETERGENTS ON A PELAGIC ECOSYSTEM, (IN FRENCH).
Centre Universitaire de Luminy, Marseille (France). Lab. d'Hydrobiologie Marine.
In: IVes journees d'etudes sur les pollutions ma-

rines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 381-384, 1979. 6 Ref, (English abstract).

Descriptors: *Detergents, *Path of pollutants, *Mathematical models, Methodology, Chemical wastes, Chemical properties, Persistence, Domestic wastes, Water pollution sources, Monitoring, Toxicity, Lethal limit, Benthic fauna, Mediterranean Sea.

An attempt to assess the input per day of anionic detergents into the Mediterranean Sea was made. Furthermore, dispersion, persistency and dilution were calculated in relation to variable fluxes and meteorological conditions. By means of a mathematical model, we have shown that detergents are better tracers of pollutant dispersion than dilution sheet. Concentrations found in the whole prospected region were very often sufficiently high to perturb the physiology and the development of many zooplanktonic species. (Deal-EIS)
W80-03234

MERCURY CONCENTRATIONS IN PELAGIC FISHES (ANCHOVY, MACKEREL AND SARDINE) FROM THE ITALIAN COAST AND STRAIT OF GIBRALTAR,
Siena Univ. (Italy). Lab. di Idrobiologio.
For primary bibliographic entry see Field 5A.
W80-03236

MONITORING OF CHLORINATED HYDROCARBONS IN WATER AND SEDIMENTS OF THE NORTH ADRIATIC COASTAL WATERS,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W80-03237

MONITORING OF CHLORINATED HYDROCARBONS IN BIOTA AND SEDIMENTS OF SOUTH ADRIATIC COASTAL WATERS,
Biological Inst., Dubrovnik (Yugoslavia).
For primary bibliographic entry see Field 5A.
W80-03238

ACCUMULATION AND DISTRIBUTION OF HEAVY METALS IN SOME MARINE ORGANISMS IN THE BAY OF IZMIR AND IN AEGEAN COASTS,
Ege Univ., Izmir (Turkey). Dept. d'Oceanographique Biologique.
For primary bibliographic entry see Field 5A.
W80-03239

HEAVY METALS AND CHLORINATED HYDROCARBONS IN PELAGIC ORGANISMS FROM THE OPEN MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-03241

CONCENTRATION OF THE HERBICIDE 2,4-D BY SOME HIGHER WATER PLANTS,
Kharkov Vodokanalniiproekt Inst. (USSR).
A. A. Titova.
Hydrobiological Journal, Vol 14, No 4, p 96-97, 1978. 1 Fig, 7 Ref.

Descriptors: *2,4-D, *Aquatic plants, *Pesticide kinetics, Herbicides, Chlorinated hydrocarbon pesticides, Path of pollutants, Radiochemical analysis, Tracers, Chemical properties, Absorption, *Bioaccumulation, *Tissue analysis, *Salvinia, *Duckweed, *Elodea, *Water milfoil, *Hornwort.

It has been established in the course of radioisotope research that there are differences in the resistance of higher water plants (Salvinia, duckweed, Elodea, water milfoil, hornwort) to the herbicide 2,4-D and in their capacity to concentrate it. The first three species are active concentrators of this preparation. The established accumulation capacity of the higher water plants confirms their potential role in water protection. (Deal-EIS)
W80-03243

HYDROCARBON CHARACTERISTICS OF THE ORGANS AND TISSUES OF SOME MARINE FISHES FROM THE MEDITERRANEAN,
Institute of the Biology of the Southern Seas, Sevastopol (USSR).
T. L. Shchekaturina, and O. G. Mironov.
Journal of Ichthyology, Vol 18, No 6, p 1026-1029, 1978. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Organic compounds, *Absorption, *Fish physiology, Chemical analysis, Animal metabolism, Path of pollutants, Marine fish, Lipids, Chemical properties, Chromatography, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea, *Paraffins.

Bottom and pelagic fish, the hake (Merluccius merluccius), the mackerel (Scomber scombrus), the scad (Trachurus trachurus), and the spiny dogfish (Squalis acanthias) caught in the western Mediterranean were analysed for hydrocarbon content. Saturated hydrocarbons in the organs and tissues of the fish ranged from 19.3 to 318.8 microg/100 g wet weight. C15, C17 and C19 accounted for the highest percentage. Of the saturated hydrocarbons with a branched chain pristane was found in considerable quantities. (Deal-EIS)
W80-03248

ON THE CORRESPONDENCE OF DATA ON THE INCUBATION OF FISH EGGS IN SOLUTIONS OF STRONTIUM-90 -- YTTRIUM-90 OF VARYING ACTIVITY UNDER LABORAROTY CONDITIONS AND IN NATURAL WATERS,
Vserossiiskii Nauchno-Issledovatelskii Inst. Prudpvpgp Rybnogo Khozyaistva, Moscow (USSR).
For primary bibliographic entry see Field 5A.
W80-03250

PHYSIOLOGICAL-BIOCHEMICAL DATA ON EXPERIMENTAL INTOXICATION OF FISH WITH 'YALAN',
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-03251

POLYCYCLIC AROMATIC HYDROCARBON CARCINOGENS IN COMMERCIAL SEAFOODS,
British Columbia Cancer Research Center, Vancouver.
For primary bibliographic entry see Field 5A.
W80-03252

ASSIMILATION EFFICIENCY OF DIETARY METHYLMERCURY BY NORTHERN PIKE (ESOX LUCIUS),
Montana State Univ., Bozeman. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03253

ACCUMULATION AND EXCRETION OF 95ZR AND 95NB BY COMMON GOBY (ACANTHOGOBIUS FLAVIMANUS),
National Inst. of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
For primary bibliographic entry see Field 5A.
W80-03256

INDICATORS OF PHOSPHORUS AND NITROGEN DEFICIENCY IN FIVE ALGAE IN CULTURE,
Department of Fisheries and Marine Services, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5A.
W80-03258

PCBS AND DDE IN COMMERCIAL FISH FEEDS,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 5A.
W80-03259

BIOAVAILABILITY OF A HYDROCARBON FROM WATER AND SEDIMENT TO THE MARINE WORM ARENICOLA MARINA,
Trinity Coll., Dublin (Ireland). Dept. of Microbiology.
M. C. Lyes.
Marine Biology, Vol 55, p 121-127, 1979. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Oil, *Worms, *Animal metabolism, Oil spills, Oil pollution, Absorption, Metabolism, Path of pollutants, Chemical properties, Animal physiology, Bottom sediments, Benthic fauna, Radiochemical analysis, Tracers, Carbon radioisotopes, Biochemistry, *Naphthalene, *Bioaccumulation, *Depuration, *Tissue analysis.

The uptake, accumulation and depuration of a labelled hydrocarbon (14C-1-naphthalene) by the marine annelid Arenicola marina were studied. Naphthalene was chosen because it is an important component of oil and is known to be toxic to marine organisms. The bioavailability of the hydrocarbon to the worm from contaminated sediment is examined and the results discussed with reference to the rehabilitation of oiled environments, as A. marina is thought to be capable, in high numbers, of greatly reworking sediments. (Deal-EIS)
W80-03260

UPTAKE AND CELLULAR DISTRIBUTION OF CADMIUM IN MYTILUS EDULIS,
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
H. H. Janssen, and N. Scholz.
Marine Biology, Vol 55, p 133-141, 1979. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Cadmium, *Absorption, *Mussels, Path of pollutants, Heavy metals, Metabolism, Animal metabolism, Animal physiology, Feeding rates, *Mercury, Cytological studies, Mode of action, Electron microscopy, Biological membranes, *Tissue analysis, *Bioaccumulation, *Midgut gland.

Cadmium uptake has been studied in starved and fed Mytilus edulis L. It is suggested that fairly elevated cadmium contents in fed mussels are not due to contaminated food, but to increased pumping rate when food is available. Highest concentration and main body burden are found in the midgut gland. Transport via haemolymph, and selective discrimination at the basement lamina of the mid-gut gland tubuli are regarded as mainly responsible for accumulation. Mercury seems to be processed in a similar was as cadmium. In the tubuli, both metals are immobilized in membrane-bound vesicles, which are finally defaecated. (Deal-EIS)
W80-03263

UPTAKE OF HYDROCARBONS BY THE MARINE DIATOM CYCLOTELLA CRYPTICA,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5A.
W80-03267

PRELIMINARY RESULTS ON UPTAKE AND ELIMINATION AT DIFFERENT TEMPERATURES OF P,P'-DDT AND TWO CHLOROBIPHENYLS IN PERCH FROM BRACKISH WATER,
National Swedish Environment Protection Board, Stockholm. Research Lab.
For primary bibliographic entry see Field 5A.
W80-03268

ACCUMULATION OF CADMIUM BY GREEN MICROALGAE,
Miyazaki Medical Coll. (Japan). Dept. of Chemistry.
T. Sakaguchi, T. Tsuji, A. Nakajima, and T.

Horikoshi.
European Journal of Applied Microbiology and Biotechnology, Vol 8, p 207-215, 1979. 11 Fig, 1 Tab, 10 Ref.

Descriptors: *Cadmium, *Absorption, *Chlorella, Chlorophyta, Scenedesmus, Chlamydomonas, Aquatic algae, Path of pollutants, Heavy metals, Metabolism, Membrane processes, Hydrogen ion concentration, *Bioaccumulation, *EDTA.

The accumulation of cadmium from aqueous systems by various green microalgae was investigated with focus on Chlorella regularis as it is known to concentrate large amounts of heavy metals. The amount of cadmium absorbed by Chlorella cells was rapid during the first 30 min following addition of cadmium and then continued to be absorbed more slowly. The uptake of cadmium by Chlorella was not markedly affected by temperature or metabolic inhibitors. Most of the cadmium absorbed by Chlorella cells was easily released by EDTA. The amount of cadmium absorbed differed markedly with the pH value of the solution and was inhibited by the presence of other divalent cations. Heat-killed Chlorella cells took up cadmium to a greater degree than living ones. From these results, it was considered that the uptake of cadmium into Chlorella cells was not directly mediated by metabolic processes, rather it appeared completely dependent upon physico-chemical adsorption on the cell surface. The ability to accumulate cadmium was species specific and found to be (in decreasing order): Chlamydomonas reinbardtii > Chlorella regularis > Scenedesmus bijuga > Scenedesmus obliquus > Chlamydomonas angulosa > Scenedesmus chlorelloides. (Deal-EIS)
W80-03276

INFLUENCE OF CRUDE OIL AND DETERGENTS ON THE CONCENTRATION OF SOME IONS IN HEMOLYMPH OF THE SHRIMP CRANGON CRANGON L. AND THE CRAB RHITHROPANOPEUS HARRISI GOULD,
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
Z. Zbytniewski, G. Drewa, F. Pautsch, and T. Dabrowska.
Kieler Meeresforschungen, Vol 4, p 366-369, 1978. 1 Tab, 12 Ref.

Descriptors: *Oil, *Detergents, *Toxicity, *Shrimp, *Crabs, Oil spills, Surfactants, Ions, Animal physiology, Animal metabolism, Sodium, Calcium, Chlorides, Magnesium, Potassium, Mode of action, Membrane processes, Permeability, Enzymes, Biochemistry, Crustaceans, Oil pollution, *Crude oil, *Tissue analysis.

Solutions of detergent or crude oil of 10 ppm, 50 ppm, and 100 ppm after 48-96 hours of exposure induce significant changes in the ionic composition of the hemolymph of the shrimp Crangon crangon and the crab Rhithropanopeus harrisi. The concentrations of sodium, calcium, and chloride ions decrease, whereas the concentration of potassium increases in both species exposed to both pollutants. The magnesium ion concentration decreases in the hemolymph of the shrimp incubated in solutions of detergent and in the crab incubated in the water containing crude oil. It is suggested that changes in the ionic composition of the hemolymph of the studied shrimps and crabs under influence of both pollutants are possibly brought about by alteration of cell membrane permeability and action on some enzyme activities. (Deal-EIS)
W80-03277

ACTIVITY OF LIVER FRUCTOSE 1,6 BIPHOSPHATASE IN RAINBOW TROUT HELD IN DIFFERENT CONCENTRATIONS OF INDISSOCIATED AMMONIA (IN ITALIAN),
Genoa Univ. (Italy). Ist. di Zoologio.
A. Arillo, L. Lamba Doria, and C. Margiocco.
Memorie dell'Istituto Italiano di Idrobiologia, Vol 36, p 163-170, 1978. 1 Fig, 4 Tab, 20 Ref. (English Summary).

Descriptors: *Enzymes, *Toxicity, *Ammonia, Rainbow trout, Hydrogen ion concentration, Biochemistry, Proteins, Fish physiology, Animal metabolism, Phosphorus compounds, Chemical analysis, Liver fructose 1,6-biphosphatase, *Tissue analysis.

Liver fructose 1,6-biphosphatase was tested in trout (Salmo gairdneri) kept in different ambient concentrations of NH3. Results show a significant decrease of fru-P2-ase activity (pH 7.5) in treated specimens after 60 min. incubation of extracts. The ratio between the observed activities at pH 7.5 and 9.5 also decreases significantly in treated specimens. These results are indicative of increased proteolytic activity in NH3 treated animals. (Deal-EIS)
W80-03279

ORGANOCHLORINES AND METALS IN HARBOUR SEALS (DUTCH WADDEN SEA),
Netherlands Inst. voor Onderzoek der Zee.
J. C. Duinker, M. Th. J. Hillebrand, and R. F. Nolting.
Marine Pollution Bulletin, Vol 10, p 360-364, 1979. 4 Tab, 24 Ref.

Descriptors: *Pesticide toxicity, *Heavy metals, *Aquatic animals, Polychlorinated biphenyls, *DDT, DDE, DDD, Dieldrin, *Zinc, *Iron, *Copper, *Manganese, *Lead, *Cadmium, *Chromium, Animal populations, Chemical analysis, Gas chromatography, Water pollution effects, Toxicity, *Seals, *Harbor seals, *Mirex, *Tissue analysis, *Bioaccumulation.

Maximum concentrations of PCB and members of the DDT family in liver, brains, kidney, spleen and heart anc Cu, Pb, Zn and Cd in brains of harbour seals found dead in the Dutch Wadden Sea are higher than those reported for specimens from the German Wadden Sea, where the population is stable in contrast to the strong reduction observed for the population in the former part. Results are also compared with data from the east coast of England. It has not yet been established which are the main factors that may be responsible for the reduction in the population. (Deal-EIS)
W80-03280

ISOLATION AND ELEMENTAL ANALYSIS OF METAL-RICH GRANULES FROM THE KIDNEY OF THE SCALLOP, PECTEN MAXIMUS (L.),
Natural Environment Research Council, Aberdeen (Scotland). Inst. of Marine Biochemistry.
For primary bibliographic entry see Field 5A.
W80-03282

EFFECT OF LONG-TERM LEAD EXPOSURE ON THE SEAWATER AND SEDIMENT BACTERIA FROM HETEROGENEOUS CONTINUOUS FLOW CULTURES,
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.). Dept. of Bacteriology.
For primary bibliographic entry see Field 5A.
W80-03283

EFFECTS OF CRUDE OIL ON THE DEVELOPMENT OF THE SHELL OF MYTILUS EDULIS (L) (MYTILIDAE, BIVALVIA), (IN FRENCH),
Laboratoire de Zoologie, Aquaculture and Pollutions Marines, Brest (France).
M. Le Pennec, and S. LeRoux.
Revue Internationale D'Oceanographie Medicale, No 55, p 49-55, 1979. 2 Fig, 1 Tab, 4 Ref. (English Abstract).

Descriptors: *Mussels, *Oil, *Toxicity, Growth stages, Larval growth stage, Mode of action, Animal metabolims, Animal pathology, Bioassay, Oil pollution, *Teratogens, *Crude oil, *Tissue analysis.

Spawned eggs of Mytilus edulis have been exposed to two crude oils. The larval development was perturbed as a consequence the prodissoconch shell was abnormally formed. These abnormal shells were first observed under a light microscope then under a scanning electron microscope. The majority of the polluted larvae show great modifications of the hinge and crystallisation of the shell. (Deal-EIS)
W80-03284

CONCENTRATIONS OF ARSENIC, SELENIUM AND TEN HEAVY METALS IN SCHOOL SHARK, GALEORHINUS AUSTRALIS (MACLEAY), AND GUMMY SHARK, MUSTELUS ANTARCTICUS GUNTHER, FROM SOUTH-EASTERN AUSTRALIAN WATERS,
Victoria Dept. of Agriculture, Melbourne (Australia).
For primary bibliographic entry see Field 5A.
W80-03285

COMBINED EFFECTS OF CADMIUM, COPPER AND LEAD ON DEVELOPING HERRING EGGS AND LARVAE,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W80-03286

LEAD TOXICOSIS AND SALT GLANDS IN DOMESTIC DUCKS,
Pisa Univ. (Italy). Cattedra Patologia Generale Comparata.
S. S. Buggiani, and S. Rindi.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 152-155, 1980. 1 Tab, 21 Ref.

Descriptors: *Lead, *Toxicity, *Ducks, *Electrolytes, Membrane processes, Osmosis, Path of pollutants, Animal metabolism, Salts, Heavy metals, *Osmoregulation, *Tissue analysis, *Blood chemistry.

In a controlled experiment ducks were force-fed standard lead doses for 8 weeks. Data collected at the end of exposure consisted of; weight; hemoglobin value; number of red blood cells (RBCs); and lead quantity in the blood. All the ducks treated showed various degrees of anemia and signs of lead poisoning. After sacrifice, the lead concentration in the nasal glands was also quantified. Lead concentrations in the nasal glands were much higher than in the blood. It was suggested that this indicated either the involvement of these glands in the elimination of lead or the impairment of transport processes at the cellular membrane levels. (Deal-EIS)
W80-03287

MERCURY, DDE, AND PCBS IN EGGS FROM A NORWEGIAN GANNET COLONY,
Tromsoe Univ. (Norway).
For primary bibliographic entry see Field 5A.
W80-03288

IDENTIFICATION OF CHLORDANES AND RELATED COMPOUNDS IN GOBY-FISH FROM TOKYO BAY,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W80-03290

EFFECTS OF P,P'-DDT, P,P'-DDD, AND P,P'-DDE ON OXYGEN UPTAKE IN THE FRESHWATER PLANARIAN (PHAGOGATA GRACILIS),
Middle Tennessee State Univ., Murfreesboro.
For primary bibliographic entry see Field 5A.
W80-03291

A POSSIBLE PHYSIOLOGICAL UPTAKE MECHANISM OF METHYLMERCURY BY THE MARINE BLOODWORM (GLYCERA DIBRANCHIATA),
Illinois State Univ., Normal. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-03293

HEAVY METALS IN THE SEDIMENTS OF THE GULF OF BOTHNIA,
Stockholm Univ. (Sweden). Dept. of Geology.

For primary bibliographic entry see Field 5A.
W80-03295

TOXIC EFFECTS AND ACCUMULATION OF CADMIUM IN SOME BENTHIC ORGANISMS OF THE BALTIC,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5A.
W80-03297

REVIEW OF EXPERIMENTS ON THE CHRONIC TOXICITY EXERTED BY SOME POLLUTANTS ON ANIMAL SPECIES FROM THE BAY OF GDANSK,
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03298

THE CYTOCHEMICAL DISTRIBUTIONS OF ZINC (ZN II) AND IRON (FE III) IN THE COMMON MUSSEL, MYTILUS EDULIS, AND THEIR RELATIONSHIP WITH LYSOSOMES,
Institute for Marine Environmental Research, Plymouth (England).
D. M. Lowe, and M. N. Moore.
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 851-858, 1979. 1 Tab, 36 Ref.

Descriptors: *Cytological studies, *Mussels, *Zinc, *Iron, Metals, Path of pollutants, Animal metabolism, Animal physiology, Animal populations, Absorption, Enzymes, Biochemistry, *Tissue analysis, *Bioaccumulation, *Bioavailability.

Zinc (Zn II) and iron (Fe III) were demonstrated histochemically in cytoplasmic inclusions shown to be lysosomes in a number of cell types in Mytilus edulis. The cellular distribution of the metals differed between the sexes; males were shown to have more zinc (Zn II) in the kidney than females, the latter appearing to use oocytes as an additional means of excretion. Differences in cellular distribution of the metals was also demonstrated between the two populations studied probably reflecting availability of the metals in their respective environment. It is proposed that detoxication of the metal ions may be achieved by compartmentation in the lysosomal-vacuolar system. (Deal-EIS)
W80-03299

A LIGHT MICROSCOPIC STUDY OF THE ACTION OF SODIUM ORTHOVANADATE ON THE GILLS OF FRESH-WATER AND SEA-WATER EELS (ANGUILLA ANGUILLA L.),
Natural Environment Research Council, Aberdeen (Scotland). Inst. of Marine Biochemistry.
K. F. Kelly, B. J. Pirie, M. V. Bell, and J. R. Sargent.
Journal of the Marine Biological Association of the United Kindgom, Vol 59, p 859-865, 1979. 2 Fig, 20 Ref.

Descriptors: *Metals, *Toxicity, *Eels, Mode of action, Cytological studies, Sodium compounds, Microscopy, Animal physiology, Chemical properties, *Vanadium, *Vanadium compounds, *Tissue analysis, *Gills.

Gills of fresh-water and sea-water eels were perfused at a constant pressure with physiological Ringer containing 10(-6)M sodium orthovanadate and examined by light microscopy. The secondary gill filaments were markedly vasoconstricted in both fresh-water and sea-water fish although the peripheral blood route around the secondary filaments was unaffected. The central venous space in the primary filaments was largely unaffected. Significant constriction of both afferent and efferent arteries on the primary filament occurred. We conclude that orthovanadate vaso-constricts eel gills mainly at the level of the secondary filaments. The study also emphasizes that chloride cells are located on both the primary and secondary filaments of fresh-water gills but solely on the primary filaments of sea-water gills. (Deal-EIS)
W80-03300

5C. Effects Of Pollution

MEASUREMENT OF CARBON DIOXIDE COMPENSATION POINTS OF FRESHWATER ALGAE,
York Univ., Downsview (Ontario). Dept. of Biology.
B. C. Birmingham, and B. Colman.
Plant Physiology, Vol 64, No 5, p 892-895, November 1979. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Aquatic algae, *Anaytical techniques, *Carbon dioxide, *Hydrogen ion concentration, *Photosynthesis, Gas chromatography, Flame photometry, Chlorella pyrenoidosa, Chlorella vulgaris, Cyanophyta, Chlamydomonas, Anabaena, Coccochloris, Phormidium, Diatoms, Cyclotella, Chlorophyta, Oxygen, Ionorganic compounds, Biochemistry, Cultures, Acidity, Alkalis(Bases).

Measurements of total dissolved algal inorganic carbon by acid release as CO2 shows that CO2 compensation points at alkaline pH are uniformly low. It is suggested that these low CO2 compensation points are maintained by an active bicarbonate uptake by algae especially at alkaline pH. Measurement of CO2 compensation points of 16 freshwater algae were made using gas chromatography in conjunction with flame ionization. The compensation points at acid pH range 4.8-41.5 microl/l. Lowest values are for Chlorella pyrenoidosa and C. vulgaris, 5.8 and 4.8 microl/l respectively, whereas those of most other algae range 15-20 microl/l. Lowering the medium O2 concentration at this pH does not have marked effects on compensation points. Compensation points for unicellular green algae, Chlorella and Chlamydomonas, blue-green algae Anabaena, Coccochloris and Phormidium, and diatom Cyclotella are not affected by changes in O2 concentration whereas compensation points of other species decrease, at most by 50%. In contrast to compensation points at acid pH, CO2 compensation points at alkaline pH are uniformly low. At air-saturated O2 concentrations, compensation points of all species range 0.2-7.2 microl/l and lowering O2 concentrations has no marked effects on any compensation points. Low, CO2-insensitive compensation points of algae are characteristic of C4 plants. (Harris-Wisconsin)
W80-03010

POLLUTION OF THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins.
Environmental Science & Technology, Vol 14, No 1, p 32-37, January 1980. 2 Fig, 2 Tab, Illust.

Descriptors: *Water pollution effects, *Baseline studies, *Chemical wastes, *Oil pollution, Environmental effects, Resources development, Coasts, Ecosystems, *Outer Continental Shelf.

Many chemicals created to satisfy technological and economic demands will eventually find their way into the marine system. In addition an estimated four million metric tons of petroleum enter the marine environment each year. To protect our natural resources the effects of chemical pollutants on marine organisms and their habitats need to be studied. In the Environmental Conservation Division of the Northwest and Alaska Fisheries Center teams made up of specialists in analytical chemistry, bio-chemistry, vertebrate and invertebrate pathology, electron microscopy, immunology, and behavioral biology are attempting to solve problems involved in identifying chemical pollution in marine environments and in relating the findings to possible alterations in the health of marine organisms. Preliminary findings indicate that interactive effects between two pollutants in marine organisms account for substantial alterations in certain biochemical systems and in cellular morphology. Interactive effects appear to bring about major alterations in biological systems of marine fishes. Reams of data acquired on the effects of exposing organisms to a single contaminants will be examined and research expanded to determine which interactions occur and the degree of their impact. (Sinha - OEIS)
W80-03011

THE TSESIS OIL SPILL: ITS IMPACT ON THE COASTAL ECOSYSTEM OF THE BALTIC SEA,
Institute of Water and Air Pollution Research, Studsvik (Sweden).
O. Linden, R. Elmgren, and P. Boehm.
Ambio, Vol 8, No 6, p 244-253, 1979. 13 Fig, 26 Ref.

Descriptors: *Oil spills, *Water pollution effects, *Ecosystems, Coasts, Environmental effects, *Outer Continental Shelf, *Baltic Sea, Tsesis oil spill, Soviet tankers.

The Tsesis study describes an attempt to investigate the full spectrum of effects of an oil spill on the ecosystem of a rather sheltered coastal archipelago in the atidal brackish Baltic Sea. The study demonstrated a number of effects of oil on various types of organisms. In general, however, the impact seems to have been of relatively short-term nature in the pelagic system, a conclusion supported also by the results of the investigations following the Torrey Canyon and Argo Merchant accidents. Increases in primary production among phytoplankton in impacted areas have been observed earlier. The stimulation of primary production in the area affected by the Tsesis oil spill is probably related primarily to the higher phytoplankton biomass in the area. The observed decrease of zooplankton in the vicinity of the ship was undoubtedly due to the acute toxic effects of the oil. The results of the investigations of the effects of the Tsesis oil on littoral communities indicate severe acute effects on all major faunal groups. These results together with results from a study of a very similar spill in the Stockholm archipelago suggest that complete recovery of a littoral community under these circumstances will take two to three years. (Sinha - OEIS)
W80-03012

MONITORING THE MARINE ENVIRONMENT, PROCEEDINGS OF A SYMPOSIUM HELD AT THE ROYAL GEOGRAPHICAL SOCIETY, LONDON, ON 28 AND 29 SEPTEMBER 1978.
Symposia of the Institute of Biology No 24, 1979. 217 p, Institute of Biology, London.

Descriptors: *Monitoring, *Water pollution effects, *Environmental effects, Resources development, Baseline studies, Oil pollution, Coasts, Surveys, Ecosystems, *Outer Continental Shelf, North Atlantic Ocean, North Sea, United Kingdom.

The theme of the symposium was the systematic observation of life in the sea and the effects of human activity on it. The Symposium brought together people interested in a wide range of topics in marine science. After the introduction on Marine Monitoring, the following papers were presented: Intertidal Surveillance; Monitoring the Effect of Oil pollution on Rocky Seashores; Systematic Surveys and Monitoring in Nearshore Sublittoral Areas Using Diving; Monitoring with Deep Submersibles; Continuous Plankton Records - Monitoring the Plankton of the North Atlantic and the North Sea; The Monitoring of Substances in Marine Waters for Genetic Damage; Monitoring Whale and Seal Populations; Biological Monitoring Around an Oil Refinery; Monitoring Radioactivity in the Marine Environment; Monitoring the Effects of Domestic and Industrial Wastes; and Marine Wildlife Conservation in the Coastal Zone. (See W80-03014 thru W80-03024) (Sinha - OEIS)
W80-03013

INTERTIDAL SURVEILLANCE,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
W. E. Jones, A. Fletcher, S. J. Bennell, B. J. McConnell, and A. V. L. Richards.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 1-23, 1979. 12 Fig, 2 Tab, 26 Ref.

Descriptors: *Monitoring, *Intertidal areas, *Water pollution effects, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, Wales(UK).

The importance of baseline studies of intertidal areas to a proper assessment of the environmental effects of pollution is described. Information is given on the coastal surveillance program established around the coast of Anglesey and in either direction along the mainland coast east and west of the island. Some trends and deductions from the collected and partially processed data are mentioned. Emphasis is placed on changes resulting from natural events so that better judgments may be made following a pollution event. (See also W80-03013) (Sinha-OEIS)
W80-03014

MONITORING THE EFFECT OF OIL POLLUTION ON ROCKY SEASHORES,
University Coll. of Swansea, (Wales). Dept. of Zoology.
A. Nelson-Smith.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 25-53, 1979. 7 Fig, 50 Ref.

Descriptors: *Monitoring, *Baseline studies, *Shores, *Water pollution effects, *Environmental effects, Oil pollution, Resources development, *Outer Continental Shelf, Rocky seashores, British Isles.

Any pronouncement about the effects of pollution upon the sedentary life of a stretch of seashore implies a knowledge both of the previous, untainted state of that shore and of the magnitude of changes which would have taken place during the period of pollution, but from purely natural causes. Many forms of marine pollution have exerted their influence at a low intensity for such a period of time that the shore biota may not been observed in their previous unaffected state or, perhaps at best, such observations may have been recorded only in a manner which does not permit careful comparison with their present condition. Even where clearly defined changes have been reliable demonstrated, it may be difficult to assign them to a particular influence (such as a polluting discharge) when others (for example, gradual climatic changes, unusual extremes of temperature, epidemics of disease, or invasions by predators, parasites, and exotic competitors) could have had a powerful an effect. The author considers all of the uses which can be made of work which was originally carried out for purposes other than monitoring of pollution. He then discusses the applicability of various methods specifically for this purpose. (See also W80-03013) (Sinha - OEIS)
W80-03015

SYSTEMATIC SURVEYS AND MONITORING IN NEARSHORE SUBLITTORAL AREAS USING DIVING,
Field Studies Council, Penbroke (England). Pollution Research Unit.
K. Hiscock.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 55-74, 1979. 4 Fig, 25 Ref.

Descriptors: *Monitoring, *Surveys, *Water pollution effects, *Environmental effects, Baseline studies, Resources development, Scuba diving, *Outer Continental Shelf, Nearshore sublittoral areas.

The use of diving in marine biology in British waters has accelerated in recent years and a description of available techniques and equipment has been prepared for publication by the present author. This paper is concerned with the strategy of carrying out biological studies using diving. The type of data collected will depend on the information needed to satisfy the aims of the survey, the time available for collection and processing of data, the methods of analysis to be used, and the level of accuracy which is possible. A knowledge of the environmental variables likely to affect the distribution and abundance of species will be required at the planning stage of a survey, particularly if it is intended to study the effect of one physical or chemical factor and reduce the variation in others by careful selection of sites. The following factors are likely to be important: exposure to wave action and tidal streams; light; depth; suspended sediment concentration; the annual temperature range; salinity differences; geographical location; substrate type; and predator or dominant cover. (See also W80-03013) (Sinha - OEIS)
W80-03016

MONITORING WITH DEEP SUBMERSIBLES,
Woods Hole Oceanographic Institution, MA.
G. T. Rowe.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 75-85, 1979. 6 Fig, 19 Ref.

Descriptors: *Monitoring, *Environmental effects, *Water pollution effects, Baseline studies, Ocean environments, Resources development, Research facilities, *Outer Continental Shelf, Submersibles, Deep Submergence Research Vessels(DSRV), DSRV Alvin.

The open ocean, because it appears so vast and far removed, has often been used as a recipient of urban and industrial wastes. Life in the shallow productive waters is vitally dependent on processes in the deep ocean. To know the consequences of using the deep-sea for waste disposal, monitoring is called for, but the great depths present formidable barriers to simple monitoring programs. One possible approach to monitoring great depths is the use of Deep Submergence Research Vessels (DSRVs). The Woods Hole Oceanographic Institution has operated DSRV Alvin since 1964 and it has been used in a variety of disciplines. Among them, increasingly, is the investigation of the effects of pollutants on the deep-sea biota and environment. The history of Alvin, its major accomplishments, and how it is now being used in deep-sea environmental quality programs is described. (See also W80-03013) (Sinha - OEIS)
W80-03017

CONTINUOUS PLANKTON RECORDS: MONITORING THE PLANKTON OF THE NORTH ATLANTIC AND THE NORTH SEA,
Institute for Marine Environmental Research, Plymouth (England).
J. M. Colebrook.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 87-102, 1979. 11 Fig, 12 Ref.

Descriptors: *Monitoring, *Plankton, *Water pollution effects, *Environmental effects, Baseline studies, Surveys, Coasts, Resources development, *Outer Continental Shelf, North Sea, North Atlantic Ocean.

Relationships between plankton and environment have been presented to provide examples of the kinds of relationship that are found and to illustrate some of the problems involved in their interpretation. There has been a marked improvement in techniques of data acquisition in recent years, particularly in the field of satellite observations, and there has been a considerable improvement in the availability of data relating both to historical series and to current observations. These trends imply that there is ample scope for further work along these lines which could provide the bases for more refined interpretations of the relationships between plankton and environment. As the environment is in a state of continuous change, the existence of a transient phase can complicate the relationships between concomitant values of input and response. In addition, plankton populations obviously exhibit persistence, for periods at least related to their generation times, and this imposes certain characteristics on sets of observations expressed as time-series. Given the limitations in the observational data, these problems can be solved only by the development of models of the processes involved. (See also W80-03013) (Sinha - OEIS)
W80-03018

THE MONITORING OF SUBSTANCES IN MARINE WATERS FOR GENETIC DAMAGE,
University College of Swansea, (Wales). Dept. of Genetics.
J. M. Parry, and M. A. J. Al-Mossawi.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 103-113, 1979. 1 Fig, 6 Tab, 6 Ref.

Descriptors: *Monitoring, *Genetics, *Water pollution effects, *Environmental effects, Baseline studies, Chemical wastes, Coasts, Resources development, *Outer Continental Shelf, Mutagenic agents, Mytilus edulis.

The use of the marine environment as a sink for the disposal of chemicals both deliberately and accidentally suggests that at least a fraction of the living organisms found in the seas and oceans may be exposed to potentially mutagenic agents. Such exposure may result in changes in the genetic architecture of marine populations and if such agents enter food chains they may lead to the unwitting exposure of human populations. The assay of the seas and oceans for the presence of mutagenic chemicals can be performed in two fundamentally different ways. One method involves chemically analysing ocean samples in order to identify constituent chemicals which may then be individually tested for mutagenic activity. The second approach involves the collection of ocean samples, concentration of the constituents, and the exposure of the resulting concentrate to a range of mutagenic screening systems. An assay system has been developed based upon the extraction of tissues derived from the mussel Mytilus edulis and the screening of these extracts for mutagenic activity using a number of microbial indicator species. Although results demonstrate the presence in mussels of chemicals which cause mutation in microbes, they provide no direct information on the potential of these chemicals to produce similar changes in the cells of higher organisms. The evaluation of their potential hazards will require the use of a range of test systems of more direct relevance to the organisms of concern. (See also W80-03013) (Sinha - OEIS)
W80-03019

MONITORING WHALE AND SEAL POPULATIONS,
British Antarctic Survey, Cambridge (England).
R. M. Laws.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 115-140, 1979. 3 Fig, 2 Tab, 88 Ref.

Descriptors: *Monitoring, *Mammals, *Water pollution effects, *Oil pollution, Environmental effects, Resources development, Baseline studies, Antarctic, *Outer Continental Shelf, Whales, Seals, Southern Ocean.

Large-scale oil exploration and exploitation in inshore and offshore areas is under way, and large industrial plants producing noxious effluents are being established in areas where they could affect marine mammal populations. Even the Antarctic is not immune. So far there is no evidence that marine mammals are seriously affected by oil-spills but the less obvious effects of disturbance, such as noise, may be important. Because of the vast areas involved and the expense, the immediate need is for further coordination of efforts, the continuation and strengthening of projects already in operation, and the establishment of pilot projects to develop new techniques. Methods need to be standardized and calibrated and arrangements for storage and retrieval of data improved because records must be longer than a single worker's career. (See also W80-03013) (Sinha - OEIS)
W80-03020

BIOLOGICAL MONITORING AROUND AN OIL REFINERY,
Imperial Coll. of Science and Technology, London (England). Dept. of Botany.
D. H. Dalby, E. B. Cowell, and W. J. Syratt.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 141-152, 1979. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Monitoring, *Oil pollution, *Water pollution effects, *Environmental effects, Ecosys-

tems, Baseline studies, Resources development, *Outer Continental Shelf, Norway, Oil refineries.

The approaches used in the biological monitoring studies carried out by ecologists of the British Petroleum Company at the Rafinor oil refinery at Mongstad on Fensfjord, 50 km NNW of Bergen, Norway are described. Some conclusions reached in regard to marine pollution are as follows: (1) if biological monitoring is employed, recording should be quantitative and in such a form that the data can be treated statistically; (2) variations in species abundance on rocky shores are often considerable from year to year, and these must be allowed for in assessing the magnitude of possible contamination; (3) no monitoring study of this kind should be carried out in a vacuum without a fairly full understanding of the general ecological processes taking place in the natural environment; and (4) biological data become more useful when the species studies are employed in a kind of bioassay and restricting the recording to rather few species of known tolerance and response. (See also W80-03013) (Sinha - OEIS)
W80-03021

MONITORING RADIOACTIVITY IN THE MARINE ENVIRONMENT,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.
N. T. Mitchell.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 153-170, 1979. 1 Fig, 5 Tab, 21 Ref.

Descriptors: *Monitoring, *Radioactivity, *Environmental effects, *Waste disposal, *Water pollution effects, Nuclear powerplants, Coasts, Estuaries, Resources development, *Outer Continental Shelf, United Kingdom.

An account of methods used in the UK to monitor the effects of controlled radioactive waste disposal from the generation of nuclear power on the marine environment is presented. Monitoring occupies an especially important role within the control structure for ensuring the safe disposal of radioactive waste, and its treatment explains this role and the use to which it is put. Marine environmental monitoring in the UK is essentially source-related and, designed and organized along critical path lines, provides a comprehensive surveillance system of the effects of operation of a large nuclear power programme. Monitoring is closely integrated with research programmes which also feed into the overall control system and so ensure that maximum information is gained from the effort available. (See also W80-03013) (Sinha - OEIS)
W80-03022

MONITORING THE EFFECTS OF DOMESTIC AND INDUSTRIAL WASTES,
Clyde River Purification Board, Glasgow (Scotland).
A. J. Newton, A. R. Henderson, and P. J. Holmes.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 171-179, 1979. 20 Ref.

Descriptors: *Monitoring, *Domestic wastes, *Industrial wastes, *Water pollution effects, Environmental effects, Baseline studies, Resources development, *Outer Continental Shelf, Ocean dumping.

The marine environment supports a wide variety of human activities including fishing and mariculture, commerce and transport, mineral exploitation, recreation, and waste disposal. All these activities have clear biological implications; however, it is on the coastal ecosystems adjacent to major centres of population that the impact of such activities, particularly waste disposal, is most pronounced. In order to prevent, reduce, or at least contain pollution by domestic and industrial effluents, the statutory authorities have had to embark on programmes of monitoring and research so that water quality criteria can be defined and the maximum permissible levels of pollutants established. (See also W80-03013) (Sinha - OEIS)
W80-03023

MARINE WILDLIFE CONSERVATION IN THE COASTAL ZONE,
Nature Conservancy, Abbots Ripton (England). Monks Wood Experimental Station.
R. Mitchell.
In: 'Monitoring the Marine Environment,' Symposia of the Institute of Biology No 24, p 181-193, 1979. 4 Ref.

Descriptors: *Monitoring, *Conservation, *Coasts, *Water pollution effects, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, British Isles.

The necessity to develop a strategy for marine wildlife conservation in British coastal waters is in large part a reaction to the many conflicting activities in this zone which seem to grow both in type and magnitude, and in the area which they affect. The basis of a possible strategy for marine wildlife conservation in the littoral and shallow sublittoral areas of Britain's coastal zone is described. Survey, surveillance, and monitoring are discussed in relation to this strategy. The basic and inevitable conclusion is that enormous resources are needed both to fund all the tactical and strategic research required and to manage and maintain an adequate marine conservation strategy. (See also W80-03013) (Sinha - OEIS)
W80-03024

THE DEVELOPMENT OF WATER QUALITY CRITERIA FOR AMMONIA AND TOTAL RESIDUAL CHLORINE FOR THE PROTECTION OF AQUATIC LIFE IN TWO JOHNSON COUNTY, KANSAS STREAMS,
Kansas Water Resources Research Inst., Manhattan.
R. H. Hazel, C. E. Burkhead, and D. G. Huggins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139561, Price codes: A08, in paper copy, A01 in microfiche. Project Completion Report, December 1979. 156 p, 26 Fig, 33 Tab, 86 Ref, 6 Append, OWRT A-088-KAN(1).

Descriptors: *Kansas, *Ammonia, *Chlorine, *Bioassay, *Water quality, Shiners, Sunfishes, Bass, Fish toxins, Crayfish, Benthos, Aquatic animals, Aquatic drift, Catfishes, Toxicity, Sewage effluents.

Mill Creek and Cedar Creek in Johnson County, Kansas, were sampled monthly from December 1977 through May 1979 to determine water quality data for the streams. Also studied were toxicity levels for selected stream fauna and fauna response to artificially stressed stream conditions. From the data, water quality criteria for ammonia and total residual chlorine (TRC) were developed. Both streams flow in a northerly direction and drain into the Kansas River, however, Mill Creek receives sewage treatment plant effluents while Cedar Creek does not. At each sampling site three samples were taken; one acid fixed for ammonia analysis, one for bacteriological testing, and one for other parameters such as pH, hardness, alkalinity, conductivity, and turbidity. Other on-site measurements were also made such as temperature and dissolved oxygen. Species used for the 96 hour acute toxicity test for ammonia and TRC include the orange throated darter, the red shiner, crayfish, and the riffle beetle. Bluegill sunfish were observed between the two test streams. Due to the sewage discharges Cedar Creek was much healthier with greater aquatic life diversity and low concentrations of pollutants. The orange throated darter was the most sensitive species to ammonia and the red shiner the most sensitive to TRC. Stream stress tests showed that the tested fish were more sensitive to stream stress. Maximum safe levels for ammonia and TRC were determined to be 0.07 mg/l and 0.02 mg/l respectively as 24 hour averages. (Seigler-IPA)
W80-03082

DIATOM AND CHRYSOPHYCEAN CYST PROFILES IN SEDIMENT CORES FROM TWO LINKED BUT CONTRASTING WELSH LAKES,
University Coll. of North Wales, Bangor. School of Plant Biology.
J. K. Elner, and C. M. Happey-Wood.
British Phycological Journal, Vol 13, No 4, p 341-360, 1978. 7 Fig, 4 Tab, 60 Ref.

Descriptors: *Paleolimnology, *Sedimentology, *Sampling, *Trophic level, History, Sediments, Oligotrophy, Eutrophication, Cores, Lake Padarn, North Wales, Lake Peris, Chrysophyta, Diatoms, Analytical techniques, On-site investigations, Wales.

Llyn Padarn and Llyn Peris, two small North Wales river-linked lakes, originally formed a single larger lake. Today they contain two contrasting algal communities. The diatom and chrysophycean cyst sequence found in long sediment cores from these lakes was studied to determine the historical extent of their trophic differences. Llyn Padarn 4.75 m long core represents c. 6,000 years, while Llyn Peris 2.1 m long core represents c. 900 years. Between 6,000 and 2,200 B.P., Llyn Padarn was acid-oligotrophic; about 2,200 years ago it became enriched. Asterionella formosa was a predominant diatom at that time. C. 2,000 B.P., the lake reverted to oligotrophy. At C. 900 B.P., Llyn Peris sediments were characterized by centric diatoms similar to those found in the Llyn Padarn sediments between C. 2,000 B.P. and the present. C. 200 B.P., Llyn Peris sediments began to show chemical changes traceable to extensive copper and slate mining near the lake. At that time Chrysophyceae became dominant in Llyn Peris while diatoms continued to abound in Llyn Padarn. A statistical analysis method is described for determining the precision of counting of the sediment samples. The most efficient counting and sampling procedure involves taking a single sediment sample from a depth horizon, preparing two replica slides, and counting the entire area of each slide. Comparison of vertical and horizontal distributions of these siliceous algae in replica sediments shows that vertical variation greatly exceeds horizontal variation; this proves that the sediment core sequence reflects changes in composition through time rather than variations in horizontal algal distribution. (Harris-Wisconsin)
W80-03101

SORPTION OF PHOSPHATE BY DANISH LAKE SEDIMENTS,
Copenhagen Univ., Hillerod (Denmark). Freshwater-Biological Lab.
O. S. Jacobsen.
Vatten, Vol 33, No 3, p 290-298, 1977. 10 Fig, 3 Tab, 17 Ref.

Descriptors: *Sorption, *Absorption, *Adsorption, *Phosphates, Denmark, Trophic level, Sediment-water interfaces, Isotherms, Lakes, Mud-water interfaces, Langmuir isotherm, Freundlich isotherm, Phytoplankton, Cycling nutrients.

Sediment samples were collected during winter 1975-1976 from eight Danish lakes of different trophic level. Analyses of the sediments were carried out for purposes of studying sorption isotherms and their relationships to sediment composition. Results of the experiments confirm that the sorption mechanism in most sediments is a very rapid reaction. Changes in external concentrations of about 1 mg phosphorus/l occur within 4-8 hrs. Iron-oxid-hydroxids in active-state sediments are the main factor influencing the sorption capacity. The highest level of sorption was obtained in experiments with oxidized mud and lake water, and pH had the most influence on sorption capacities. In reduced mud only low sorption capacities were found as a result of reduction in the active iron content of the sediment. In organic and iron-poor sediments low sorption capacities or none at all were obtained. Sorption to iron-oxid-hydroxids is a chemosorption process and consequently has a maximum of sorption sites. Mathematically it can best be described by a Langmuir isotherm. Sorption to organic matter, clay, minerals, and inorganic surfaces must be regarded as adsorption, best described by a Freundlich isotherm. For natural sediments the ratio between chemosorption and

adsorption provides data for selecting the correct isotherm. (Harris-Wisconsin)
W80-03102

SPATIAL VARIABILITY OF PHYTOPLANKTON BIOMASS IN THE SURFACE WATERS OF LONG ISLAND,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. F. Lekan, and R. E. Wilson.
Estuarine and Coastal Marine Science, Vol 6, No 3, p 239-251, 1978, 8 Fig, 8 Ref.

Descriptors: *Phytoplankton, *Biomass, *Long Island Sound(NY), *Spatial distribution, Chlorophyll, Analytical techniques, Correlation analysis, Statistical methods, Temperature, Salinity, Wavelengths, New York.

The relative importance of interactions among various biological and physical processes is analyzed in terms of affects of these differences on varying sizes (intermediate to large-scale) of in-vivo chlorophyll-a observed in surface waters along a 192 km transect through eastern Long Island Sound and nearby coastal waters. Statistical analysis of records of chlorophyll-a, temperature and salinity confirms the existence of small structure in chlorophyll-a and larger structure in temperature and salinity. Cross-covariance analysis indicates that there is no correlation between the chlorophyll-a structure and that of temperature and salinity. The power spectra for these three variables are similar at wavelengths of 5-20 km, suggesting that structure at these wavelengths is determined by physical processes. At wavelengths shorter than 5 km the chlorophyll spectrum exhibits a slope of approximately -1, while temperature and salinity have steeper slopes (-5/3). Power spectra for temperature and salinity steepen at wavelengths greater than 20 km, reflecting the large scale changes in these parameters associated with the transition from estuarine to coastal waters. Chlorophyll-a structure at these wavelengths is related to the distribution of nutrients, especially ammonium. (Harris-Wisconsin)
W80-03104

A DISCRETE MODEL FOR THE STUDY OF A LAKE,
Laboratories d'Automatique, Saint Martin D'Heres (France).
S. Gentil.
Applied Mathematical Modeling, Vol 3, No 3, p 193-198, 1979. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Lakes, *Simulation analysis, *Computer models, *Eutrophication, Model studies, Mathematical models, Equations, Phytoplankton, Zooplankton, Organic matter, Trophic level, Ecology, Nutrients, Aquatic environment, Predation, Epilimnion, Cycling nutrients, Computer programs.

An original discrete lake model focuses on cultural eutrophication (mineral and organic inputs) effects on a lake epilimnion, especially phytoplankton. The model is based on prey-predation formulation and material balances. State variables include algae, herbivorous zooplankton, organic materials, mineral materials, and nutrients. It takes into account environmental biological capacity and the mineralization process. The system consists of several feedback interconnected loops: it is a multivariable, nonlinear, stationary system. The overall program is composed of 76 statements. Model behavior is tested through various simulations which study the influence of certain parameters and pollution input modification. Pure delay in zooplankton reproduction is introduced. (Danovich-Wisconsin)
W80-03106

MEASUREMENTS OF MINERALIZATION OF PHYTOPLANKTON DETRITUS IN AN OLIGOTROPHIC LAKE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
J. J. Cole, and G. E. Likens.
Limnology and Oceanography, Vol 24, No 3, p 541-547, 1979. 4 Fig, 1 Tab, 32 Ref.

Descriptors: *Oligotrophy, *Phytoplankton, *Bacteria, *Degradation(Decomposition), *Microbial degradation, *Mirror Lake(NH), Detritus, Microorganisms, Respiration, Tracers, On-site tests, On-site investigations, Analytical techniques, Carbon, Size, Biochemistry, Particle size, Enzymes, Microbiology, New Hampshire, Measurement.

Phytoplankton mineralization, or decomposition, in Mirror Lake, a small oligotrophic lake in New Hampshire, is largely due to bacterial activity. Mineralization activity is the process which produces (C-14)CO2 from C-14 labeled phytoplankton substrate, particulate and dissolved. Incubation bottle and (C-14)CO2 trapping system design provides a method for measuring mineralization rates in microbial communities under in situ temperatures and dissolved gas concentrations without extreme experimental manipulations. From 3-9% of the carbon photoassimilated in 72 h in oligotrophic Mirror Lake is returned to the inorganic carbon pool over an equal period by a mineralization agent in the water column. At least 25%-30% of the particulate phytoplankton detritus is mineralized to CO2 over 500 h. Differential filtration studies indicate the mineralization agents are quite small. 95% of unfiltered activity passed 0.4 micro m Nuclepore filters while only 16% passed 0.45 micro m Millipore filters; many small bacteria are actually trapped inside cellulose-acetate Millipore filters. Since 86% of the unfiltered mineralization activity does not pass 0.1 micro m Sartorius filters, the bulk of the mineralization activity stems from microorganisms (particulate) rather than soluble enzymes (dissolved material). Mineralization activity correlates with very small particles, is inhibited by penicillin-chloraphenicol, and is completely destroyed by heat (121C) or Formalin. Such an agent is presumably bacterial. (Danovich-Wisconsin)
W80-03107

AMAZON LAKES: WATER STORAGE AND NUTRIENT STRIPPING BY ALGAE,
Duke Univ., Beaufort, NC. Marine Lab.
T. R. Fisher, Jr., and P. E. Parsley.
Limnology and Oceanography, Vol 24, No 3, p 547-553, 1979. 1 Fig, 1 Tab, 30 Ref. NSF PCM 75-06451, OCE 76-82084.

Descriptors: *Amazon River, *Lago Janaûaca, Brazil, *Water levels, *Floods, *Nutrients, Lakes, Water storage, Rainfall, Seasonal, Flood plains, Flood discharge, Chlorophyta, Algae, Cyanophyta, Growth rates, Productivity, Primary productivity, Runoff, River flow, Phytoplankton, Mixing, Chlorophyll, Ammonia.

During the rainy season, Amazon River water levels rise 10 m, flooding a broad band at least 50 km away and significantly affecting phytoplankton growth in adjacent lakes. The lakes function as a capacitor within the river system and during storage major changes in water chemistry occur due to intense biological activity. Lago Janauaca is a large shallow lake connecting with Rio Solimoes (Amazon River above Rio Negro junction) by a channel 12 km long. The lake is productive (2.2 g C/sq m d), although low in nutrients (0.10 micro g-at nitrate/l, 0.14 micro g-at phosphates /l), and contains large phytoplankton concentrations (52 micro g/chl/l). About 70% of phytoplankton cell volume is accounted for by two green algae, Arthrodesmus and Ankistrodesmus, and blue-green Calothrix. In the nutrient-rich Rio Solimoes (12 micro g-at nitrates/l, 0.90 micro g-at phosphates/l), primary productivity is low (0.063 g C/sq m d) due to poor light penetration caused by turbidity. At the start of the rainy season in December 1976, the rising Amazon began its annual incursion into Lago Janauaca. During the first month, water levels rose 1.5 m. Horizontal variations in lake transparency and nutrient concentrations indicated river water penetration. In the mixing zone, nearly 75% of the phytoplankton was composed of blue-green algae such as Anabaena, Oscillatoria, and Anacystis. Nitrate and phosphate removal was virtually complete in this zone. Ammonia concentrations peaked, lagging just behind chlorophyll peaks. (Danovich-Wisconsin)
W80-03108

A COMPARISON BETWEEN THE CELL DIVISION RATE OF NATURAL POPULATIONS OF THE MARINE DIATOM SKELETONEMA COSTATUM (GREVILLE) CLEVE GROWN IN DIALYSIS CULTURE AND THAT PREDICTED FROM A MATHEMATICAL MODEL,
Skidaway Inst. of Oceanography, Savannah, GA.
J. A. Yoder.
Limnology and Oceanography, Vol 24, No 1, p 97-106, 1979. 5 Fig, 3 Tab, 29 Ref. NSF GA 31391.

Descriptors: *Dialysis, *Diatoms, *Cultures, *Mathematical models, *Growth rates, Regression analysis, Cytological studies, Narragansett Bay(RI), Marine algae, Phytoplankton, Population, Sea water, Temperature, Water temperature, Light intensity, Silicates, Nutrients, Ecosystems, Equations, On-site investigations, Forecasting, Rhode Island, Skeletonema costatum.

During the 1977 winter-spring phytoplankton bloom in Narragansett Bay, Rhode Island, cell division rates of natural Skeletonema costatum populations encapsulated in dialysis bags and exposed to bay water could be predicted from equations primarily formulated from batch culture studies of a single S. costatum clone. Equations incorporating only temperature and light intensity effects explain cell division rates; these parameters account for 90% of the observed variation. However, predictions based solely on temperature levels and light intensity tend to overestimate observed division rates. When an expression incorporating the combined effect of silicate concentration, light intensity and temperature on cell division rate is used, the relationship gives better results. Terms not included in the model are light acclimation, temperature-dependence of K-s, and short changes in bay water nutrient concentrations such as dissolved inorganic nitrogen and phosphorus. Results tend to support the validity of an autecologival approach to studying marine phytoplankton dynamics. At weekly intervals January-May 1977, during the winter-spring bloom, phytoplankton samples were collected from Narragansett Bay, encapsuled in dialysis bags, incubated in flowing seawater for 2-5 days at two different light levels, and S. costatum cell division rate was determined. (Danovich-Wisconsin)
W80-03109

FUNCTIONALLY DISTINCT CLASSES OF COMPLEX PHOSPHORUS COMPOUNDS IN LAKE WATER,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
D. A. Francko, and R. T. Heath.
Limnology and Oceanography, Vol 24, No 3, p 463-473. 1979. 5 Fig, 1 Tab, 35 Ref, EPA 10160-HCS-R801936.

Descriptors: *Orthophosphate, *Chromatography, *Twin Lakes(OH), *Crazy Eddie Bog(OH), *Phosphorus compounds, Eutrophication, Phosphorus, Lakes, Light, Light intensity, Phosphates, Phytoplankton, Nutrients, Cycling nutrients, Chemical reactions, Water chemistry, Water, Bogs, Fractionation, Ultraviolet radiation, Anion exchange, Enzymes, Ohio.

Chromatographic results from two eutrophic lakes, East and West Twin Lakes, and a humic bog, Crazy Eddie Bog, in northeastern Ohio suggest that phosphate is released from complex phosphorus compounds and made available to planktonic organisms by two distinct modes. One release mode is dependent on phosphatase activity and independent of incident light intensity. The other functional compound class, those insensitive to phosphatase activity, release orthophosphate simultaneously on exposure to sufficient doses of sunlight. Classes are mutually exclusive and account for all the filtrable complex phosphorus compounds in the lakes. The lakes contain numerous low molecular weight compounds which are resistant to low-dose ultraviolet (UV) irradiation but readily release orthophosphate upon treatment with alkaline phosphatase. Humic bog filtrable phosphorus compounds are predominately high

molecular weight, cochromatograph with yellow acids in each fractionation procedure, and resist enzyme hydrolysis but release orthophosphate upon irradiation with low UV light doses. The UV phosphorus bound to material sensitive to UV light was released as othrophosphate within 3 h, suggesting the phosphate release by sunlight is important in phosphorus dynamics in systems predominated by UV-sensitive compounds. Filtrable phosphorus compounds were fractionated by anion-exchange and gel-filtration chromatography. (Danovich-Wisconsin)
W80-03110

FIREFLY ASSAY OF ADENINE NUCLEOTIDES FORM ALGAE: COMPARISON OF EXTRACTION METHODS,
Stockholm Univ., Sweden. Inst. of Botany.
C. M. Larsson, and T. Olsson.
Plant and Cell Physiology, Vol 20, No 1, p 145-155. 1979. 1 Fig, 4 Tab, 38 Ref.

Descriptors: *Algae, *Adenine nucleotides, *Analytical techniques, *Evaluation, Biochemistry, Cytological studies, Assay, Firefly luciferase, Laboratory tests, Plant physiology, Energy, Methodology, Testing procedures, Metabolism, Light, Darkness, Measurement, Buffering.

Six different methods for extraction of adenine nucleotides from algae were evaluated: Tris-buffer, ethanol, chloroform, sulfuric acid, trichloroacetic acid (TCA), and perchloric acid (PCA). With sampling times in the order of seconds, extraction in-situ with TCA or PCA gives the highest total extraction in combination with highest ATP proportions, that is, high energy charges and ATP/ADP ratios. High (ATP+ADP+AMP) yields indicate complete release of adenine nucleotides from algae. Methods resulting in high energy charges give lower variabilities of ATP determinations than other methods indicating fast inactivation of adenine nucleotide metabolism. Methods resulting in high energy charges also give better time resolution in dark-light transitions than other methods. Extraction of illuminated algae in-situ with the different methods results in great variations between ATP, ADP, and AMP proportions while adenine nucleotide sum varies less. Tris-extraction performed by sample withdrawal is much more efficient than when performed in-situ due to high initial concentration and extraction medium temperature. Experimental organisms were Anacystis nidulans, Euglena gracilis, Chlorella kessleri and Scenedesmus obtusiusculus. Adenine nucleotides were determined by firefly luciferase assay. (Danovich-Wisconsin)
W80-03111

SEASONAL CHANGES IN THE STANDING CROP OF AN EPILITHIC ALGAL POPULATION ON THE NORTH SHORE OF GREAT SLAVE LAKE,
Canada Environmental Service, Yellowknife (Northwest Territories).
J. W. Moore.
Canadian Journal of Botany, Vol 57, No 1, p 17-22, 1979. 2 Fig, 3 Tab, 31 Ref.

Descriptors: *Algae, *Standing crops, *Great Slave Lake, Canada, *Seasonal, Population, Density, Epilimnion, Diatoms, Ecological distribution, Chrysophyta, Chlorophyta, Cyanophyta, Euglena, Aquatic microorganisms, Speciation, Nutrients, Alkalinity, Distribution.

Epilithic algal populations on the north shore of Great Slave Lake, Canada, studied June 1975-November 1976, increase rapidly in May immediately after disappearance of ice, show only small fluctuations during the summer and wane during October. Great Slave Lake is the second largest lake in northern Canada with 28,800 sq km total area. It has 450 km maximum length and 600 m maximum depth. Rocks on the north shore are covered with large Ulothrix zonata (Chlorophyta) growths. A total of 187 microscopic algal species were recorded: 142 Bacillariophyta, 28 Chlorophyta, 10 Cyanophyta, and seven others. Predominant diatom species are Gomphonema olivaceum, G. ventricosa, Fragilaris capucina, and Cymbella ventricosa. The most commonspecies are Oscillatoria limosa, Dinobyron bavaricum, and Euglean. Microsopic algal density reaches peak abundance (2 billion cu micro m/sq cm) irregularly throughout the growing season. However, filamentous algae, mainly Ulothrix zonata, reaches maximum densities (60 mg/sq cm dwt) during July. Common epilithic algae in the east arm of the lake include Tabellaria flocculosa, Rhopalodia gibba, Cymbella angustata, C. microcephala, Anomoeneis vitrea, Achnanthes minutissima, and Ulothrix zonata. Algal densities are considerably less than those on the north shore due to lower nutrient and higher alkalinity levels. Maximum abundance for microsopic and filamentous algae are 1.05 billion cu micro m/sq cm and 4.1 mg/sq cm, respectively. (Danovich-Wisconsin)
W80-03112

EFFECT OF GROWTH IRRADIANCE ON THE MAXIMUM PHOTOSYNTHETIC CAPACITY OF WATER HYACINTH (EICHHORNIA CRASSIPES (MART.) SOLMS),
Southern Weed Science Lab., Stoneville, MS.
D. T. Patterson, and S. O. Duke.
Plant and Cell Physiology, Vol 20, No 1, p 177-184, 1979. 4 Tab, 25 Ref.

Descriptors: *Water hyacinth, *Light intensity, *Photosynthesis, *Adaptation, *Irradiance, *Plant physiology, Oxygen, Light, Laboratory tests, Stomata, Resistance, Leaves, Chlorophyll, Proteins, Statistics, Growth rates, Plant growth, Transpiration, Age.

In laboratory experiments water hyacinth adapts photosynthetically to high irradiance; this adaptation is limited to expanding leaves and younger leaves. Both short- and long-term high irradiance effects on photosynthetic capacity are manifested through increases in mesophyll conductance, soluble protein content and specific leaf weight. Maximum photosynthetic rates and low oxygen enhancement effects indicate that the water hyacinth possesses the C3 photosynthesis pathway. Increased irradiance during growth results in greater light-saturated photosynthetic rates. In air containing 21% oxygen maximum photosynthetic rates are 14, 29, and 34 mg CO_2/sq dm h for plants grown in artificial light at 90 and 750 micro E/sq m sec and full sunlight, respectively. Photosynthetic rates in 1% oxygen are 50% greater than rates in normal air indicating photorespiration. Variations in mesophyll conductance could account for 91% of the variations in light-saturated photosynthetic rates. Variations in protein content or specific leaf weight could account for 75% of the variation in photosynthetic rate. Stomatal and mesophyll conductances in old leaves are unaffected by transfer from low to high irradiance. However, in young expanding leaves, stomatal conductance significantly decreases by transfer while mesophyll conductance significantly increases. (Danovich-Wisconsin)
W80-03114

ATP AS A MEASURE OF LIVING PHYTOPLANKTON CARBON IN ESTUARIES,
Quebec Univ., Rimouski. Dept. of Oceanography.
M. Sinclair, E. Keighan, and J. Jones.
Journal of the Fisheries Research Board of Canada, Vol 36, No 2, p 180-186. 1979. 5 Fig, 1 Tab, 29 Ref.

Descriptors: *Phytoplankton, *Carbon, *St. Lawrence Estuary, *Analytical techniques, *ATP, Biomass, Estuaries, Measurement, Chlorophyll, Cytological studies, Regression analysis, Heterotrophy, Spatial distribution, Bacteria, Evaluation, Plankton, Microorganisms.

Comparisons are made between living phytoplankton carbon (C) estimated by ATP and cell volume transformation methods on phytoplankton in the Lower St. Lawrence Estuary. In high biomass samples, greater than 10 micro g C/l by cell volume transformation, both methods agree. In low biomass samples, the cell volume transformation method seriously underestimates C relative to the ATP methods. ATP estimates may be high due to contamination by animal and bacterial ATP. In 14 of 18 samples, estimated microzooplankton contamination is 3% of ATP-derived C and in one sample 19%. ATP accuracy as a measure of living phytoplankton C in general is debatable, but in estuaries in which nutrient limitation is negligible, it is a moderately accurate estimate when phytoplankton biomass is medium to high (1 micro g chlorophyll a/l). In the Lower St. Lawrence, unless exceptionally high bacterial biomass is present, heterotorphic contamination is not large. Considerable variability with depth and time is observed in the estimated carbon/chlorophyll-a ratio, especially during high biomass when ATP-derived phytoplankton C is reliable. The variable ratio suggests the inapplicability of using a constant ratio for estimating C from chlorophyll a, or of using chlorophyll regression analysis on particulate C to estimate the carbon/chlorophyll a ratio, in this environment. (Danovich-Wisconsin)
W80-03115

NOTES ON THE PHYTOPLANKTON PERIODICITY OF ROSTHERNE MERE, CHESHIRE, 1967-1977,
Freshwater Biological Association, Ambleside (England).
C. S. Reynolds.
British Phycological Journal, Vol 13, No 4, p 329-335, 1978. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Rostherne Mere, *Phytoplankton, *Succession, *Algae, Dominant organisms, Sediments, Sampling, Microcystis aeruginosa, Ceratium, Diatoms, Cryptophyta, Anabaena, Life history studies, England.

Sedimentary samples of 0-4.5 columns were collected intermittently 1967-1977 from Rostherne Mere, one of the largest and deepest lakes of the Shropshire-Cheshire Plain in England. Seasonal phytoplankton succession and interactions between the two dominant algae, Microcystis and Ceratium, were studied. Microcystis aeruginosa was overwhelmingly dominant for five summers; Ceratium dominated in two of the remaining years; diatoms and Anabaena spp. were the most dominant in the other year. Algal biomass was generally low during the first half of the year. Periodicity of Microcystis aeruginosa has been shown as closely related to the annual cycle of stagnation and destratification, while the high nutrient status of the water and the ability of vegetative colonies to descend and over-winter on the bottom muds are factors contributing to its successful growth in the lake. In 1971 and 1975 Ceratium not only replaced Microcystis but growth culminated in crops comparable to the largest ones of Microcystis. The maxima of these algae in seven years were reciprocal though not necessarily inversely correlated. Ceratium is able to succeed if the earlier and potentially more rapid growth of Microcystis is inhibited for any reason, including nutrient limitation or parasitic attack. When neither Microcystis nor Ceratium are abundant, the summer phytoplankton is dominated by diatoms and Anabaena. The interludes of Ceratium dominance are potentially useful for sediment stratigraphy interpretations. (Harris-Wisconsin)
W80-03116

BIOSYNTHESIS AND RELEASE OF ORGANOARSENIC COMPOUNDS BY MARINE ALGAE,
Scripps Institution of Oceanography, La Jolla, CA.
M. O. Andreae, and D. Klumpp.
Environmental Science and Technology, Vol 13, No 6, p 738-741, 1979. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Biochemistry, *Marine algae, *Arsenic compounds, *Kinetics, *Metabolism, Arsenic radioisotopes, Nutrients, Organic compounds, Algae, Cytological studies, Coccolithopore, Phosphates, Analytical techniques, Bioaccumulation, Phytoplankton, Plant physiology, Cultures, Tracers.

Arsenate uptake from seawater, organoarsenic compound biosysthesis, and release of arsenite, methyl arsonate, and dimethyl arsinate were studied in pure marine phytoplankton cultures. Marine phytoplankton actively take up arsenate at natural concentrations from its environment and regulate

cellular arsenic levels independently of phosphate concentrations over large concentration ranges. Significant differences exist between algal species, both in terms of uptake rates and type and number of compounds produced. In addition to substantial arsenic amounts strongly bound to cell structural parts, up to 12 soluble organoarsenic compounds were formed. A five day arsenate uptake experiment using Platymonas cultures and As-74 as a radioactive tracer shows that cellular arsenic content increases during the first two days, then stabilizes while arsenic in the medium drops 35% from 13 nM and phosphate falls from 19 to 0.7 micro M. Large variations in phosphate concentrations does not significantly influence cellular arsenic concentrations. Biosynthetic studies were conducted on Skeletonema costatum, Platymonas suecica, Gonyaulux polyedra, and Cricosphaera carteri. With the exception of Crisocosphaera, all cultures incorporated significant amounts of arsenic (13-78%). All species released substantial amounts of methyl arsonate and dimethyl arsinate into their environment. (Danovich-Wisconsin)
W80-03118

EFFECTS OF NUTRIENTS AND TEMPERATURE ON DECOMPOSITION OF MYRIOPHYLLUM SPICATUM L. IN A HARD-WATER EUTROPHIC LAKE,
Wisconsin Univ.-Madison. Dept. of Botany.
S. R. Carpenter, and M. S. Adams.
Limnology and Oceanography, Vol 24, No 3, p 520-528, 1979. 3 Fig, 2 Tab, 40 Ref, NSF DEB-75-19777.

Descriptors: *Nutrients, *Temperature, *Lake Wingra(WI), *Decomposing organic matter, *Degradation(Decomposition), *Myriophyllum spicatum, Nitrogen, Phosphorus, Environmental effects, Macrophytes, Laboratory tests, Mathematical models, Eutrophication, Deterioration, Detritus, Plant physiology, Aging(Physical), On-site investigations, Forecasting, Water temperature, Equations, Wisconsin.

Laboratory decay rate predictions of Myriophyllum spicatum shoots explain Lake Wingra, Wisconsin, field variance well, but systematically underestimates field decay rates. Temperature, phosphorus, and nitrogen effects on shoot decay were examined in the laboratory. Equations developed from laboratory data predicted decay in Lake Wingra; predictions were then tested against litter bag data. Nitrogen enrichment significantly increases the decay coefficient while phosphorus enrichment does not. Tissue nitrogen and nitrate enrichment both significantly influence the decay coefficient. In laboratory experiments, phosphorus is lost from tissues during decay, corroborating with absence of phosphorus limitation. In contrast, little nitrogen is liberated. Over condition ranges examined, nitrogen saturation of decay rates does not occur. Therefore, laboratory and field data show that nitrogen content linearly corresponds to decay rates. Decay coefficients increase with increasing temperature to 28C and then decline. Water temperature and initial tissue nitrogen content are useful factors for predicting M. spicatum decay rates in Lake Wingra. Predictions and observations are similar at low decay rates, but at high decay rates, predictions are only 60% of observed values. Inaccuracy is explained by important biological differences including more rapid nitrogen accumulation by detritus decaying in the lake, probably due to greater nitrogen availability; detritus colonization rates by microbes; and invertebrate activities. (Danovich-Wisconsin)
W80-03119

EXPRESSING THE PHOSPHORUS LOADING CONCEPT IN PROBABILISTIC TERMS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. C. Chapra, and K. H. Reckhow.
Journal of The Fisheries Research Board of Canada, Vol 36, No 2, p 225-229, February 1979. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Phosphorus, *Probability, *Nutrient loading, *Vollenweider models, *Reliability, Limnology, Management, Lakes, Eutrophication, Mathematical models, Statistics, Nutrients, Forecasting, Trophic level, Variability, Risks, Water quality, Estimating, Temperate.

Data representing 117 North Temperate Lakes were used to estimate uncertainty of a phosphorus loading model. Graphical representations demonstrate the importance of including probabilistic information in phosphorus loading calculations. Vollenweider's phosphorus loading plots predict a lake's trophic state on the basis of variables representing its phosphorus loading, morphometry, and hydrology. Plots are statistical since they represent generalizations drawn from large numbers of lakes. They are also deterministic in that a fixed predicted value results from any given set of independent variables. Predictions are useful estimates but models do not include information on reliability or prediction uncertainty. This paper quantifies the unexplained variability, or uncertainty of a phosphorus leading model. The procedure has shortcomings: (1) Results are applicable only within the range of conditions represented by the data set. Climatic range is limited to the North Temperate Zone. (2) The model is based on completely mixed lake conditions: it predicts the average phosphorus concentration in a lake and does not predict temporal or spatial deviations. (3) Errors exist in model variable estimates, particularly phosphorus inflow concentration. (4) While phosphorus enrichment assumes eutrophication, other parameters (chlorophyll-a, Secchi depth, dissolved oxygen) provide a more realistic basis for analyzing uncertainty of lake trophic state calculations. (Danovich-Wisconsin)
W80-03120

AMMONIA VOLATILIZATION OF WINTER SPREAD MANURE,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
T. S. Steenhuis, G. D. Bubenzer, and J. C. Converse.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 1, p 152-161, 1979. 6 Fig, 5 Tab, 23 Ref.

Descriptors: *Manure, *Volatility, *Ammonia, *Winter, Regression analysis, Evaporation, Physical properties, Nitrogen, Drying, Freeze-thaw tests, Dehydration, Temperature, Winds, Ureas, Nitrogen compounds, Fertilizers, Equations, Laboratory tests, On-site tests, Surface runoff, Seasonal.

Winter manure spreading reduces ammonia volatilization because wind speeds and temperature are normally lower and a large amount of manurial nitrogen is in the urea form. This paper determines parameters affecting ammonia volatilization from winter manure spreading and develops an equation to predict the effect of manure loading and environmental factors such as wind speed and temperature on volatilization. Doubling wind velocity results in halving the ammonia volatilization half life. Spreading manure during low air turbulence periods and incorporating it into the soil as soon as possible leads to minimum volatilization bases. Urea conversion to ammonia limits ammonia volatilization following winter spreading. Relative air humidity has no appreciable effect on volatilization. Drying is not required for volatilization. Higher application rates increase volatilization half-life. Freezing and thawing does not increase volatilization. On 22 January 1976, a manure spreading field experiment began. Half-life for volatilized ammonia was 11 days assuming 30% of ammonia infiltrated into the soil shortly after spreading. Temperatures during the 14 day experiment varied +10C to -28C with -2C average. When surface runoff occurs due to winter thaw, melt water may contain large amounts of unvolatilized nitrogen. (Danovich-Wisconsin)
W80-03122

NUTRIENT BUDGETS OF A TEMPORARY POND ECOSYSTEM,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
J. J. Cole, and S. G. Fisher.
Hydrobiologia, Vol 63, No 3, p 213-222, 1979. 3 Fig, 6 Tab, 26 Ref.

Descriptors: *Lost Pond(MA), *Ecosystems, *Energy budget, *Cycling nutrients, *Nutrient budgets, Nutrients, Kinetics, Carbon, Shallow water, Ponds, Temporary pond stage, Nutrient transport, Seasonal, Organic matter, Organic loading, Rainfall, Primary productivity, Respiration, Seepage, Massachusetts.

Input-output budgets of organic carbon and several inorganic nutrients in temporary Lost Pond, central Massachusetts, 1974-1975 suggest that during summer months, small ponds are open systems with respect to nutrients yet closed energetically. At full spring volume, Lost Pond has 3500 sq m surface area, 73 cm mean depth, and 2700 cu m volume. The pond's watershed is 8.3 ha of uninhabited forest. Water enters the pond primarily by subsurface seepage. Typically the pond dries over the summer and fills again in late October. In December about one-third of the pond water is ice. Dissolved organic matter is lowest (3-4 mg/l) in winter and early spring and increases dramatically to a maximum value of 45 mg/l in summer dry periods. Based on the assumption that sodium inputs are balanced by exports, nutrient budgets indicate that (1) Calcium, magnesium and chloride inputs are balanced by exports and flow through the system. (2) Nitrate, phosphate and sulfate are all retained during both summers indicating nutrients may be converted to some other form by the system. (3) Dissolved organic matter is released by the system indicating the presence of an internal source. (4) Potassium is either retained or released. During summer, rainfall accounts for 21-41% of the hydrologic input. Macrophyte primary production is the major organic carbon input and heterotrophic community respiration is responsible for 84% of the organic carbon output. (Danovich-Wisconsin)
W80-03123

RELATIONSHIP BETWEEN PRODUCTIVITY AND N2 (C2H2) FIXATION IN A THALASSIA TESTUDINUM COMMUNITY,
State Univ. of New York at Stony Brook. Marine Science Research Center.
D. G. Capone, P. A. Penhale, R. S. Oremland, and B. F. Taylor.
Limnology and Oceanography, Vol 24, No 1, p 117-125, 1979. 3 Fig, 9 Tab, 36 Ref. NSF OCE 74-01986, OFF 72-02716 AT-40-1-4493.

Descriptors: *Nitrogen fixation, *Primary production, *Bimini Harbor, Bahamas, *Thalassia, Productivity, Tidal waters, Plant groupings, Metabolism, Growth rates, Methodology, Analytical techniques, Leaves, Epiphytes, Plant populations, Plant physiology, Standing crop, Plant tissues, Plant growth, Rhizomes, Rhizosphere, Biological communities, Carbon, Bahamas.

July 1976 investigations of Thalassia testidium beds in Bimini Harbor (Bahamas) concludes that nitrogen (N) fixation directly relates to productivity, providing good support for Patriquin's hypothesis. Data also suggest independence of macrophyte and its leaf epiphytes with respect to N metabolism. Standing stocks of Thalassia leaves plus epiphytes were 200 g dwt/sq m. Production assessed by the C-14 method considerably exceeds that determined by methods of Zieman and Patriquin. The latter methods determine production by leaf growth measurements and by applying an empirical formula based on leaf dimensions. Production differences are due to photosynthate utilization in other processes such as rhizome production, plant respiration and microbial N fixation in the rhizosphere. Sediment fixation constitutes the bulk of the total N fixed. N fixation in the rhizosphere provides either 12-22% (C-14 method) or 21-48% (Zieman technique) of the N required for leaf production. Rhizome growth N requirements are small due to high carbohydrate tissue contents. N fixed in the rhizosphere contribute predominately to macrophyte production, whereas phyllosphere N fixation primarily promotes leaf epiphyte development. N fixation significantly correlates with C02 fixation rates when all community components are considered. N fixation is important to production in Thalassia communities and the plant and its leaf epi-

phytes may be distinct entities in terms of N and carbon metabolism. (Danovich-Wisconsin)
W80-03124

BIOLOGICAL AND WATER QUALITY EFFECTS OF ARTIFICIAL MIXING OF ARBUCKLE LAKE, OKLAHOMA, DURING 1977,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Hydrobiologia, Vol 63, No 3, p 255-262, 1979. 6 Fig, 6 Tab, 21 Ref. OWRT A-068-OKLA(2).

Descriptors: *Water chemistry, *Water quality, *Arbuckle Lake(OK), *Algae, *Mixing, *Destratification, Water circulation, Biomass, Chlorophyll, Lake restoration, Lakes, Water quality control, Respiration, Ammonia, Biochemical oxygen demand, Chemical properties, Ecosystems, Dissolved oxygen, Thermocline, Epilimnion, Hypolimnion, Environmental effects, Secchi disks, Primary productivity, Oklahoma.

Artificial mixing decreased the ratio gross production: community respiration below unity in Arbuckle Lake, Oklahoma, 1977 and the lake ecosystem became more heterotrophic, suggesting that lakes which are not artificially mixed have lower net primary productivities than lakes which are not artificially mixed. This paper describes the effects of total lake mixing with 16 axial flow pumps, on Arbuckle Lake water quality, algal biomass, and community metabolism. Pumping began on 1 July 1977. Mechanical pumping significantly lowered the thermocline from 9-15 m and delivered dissolved oxygen to depths normally anoxic. Pumping effects on other water quality parameters are less clear, however. Epilimnion water quality was basically the same in 1976-1977. Concentrations of S and Mn were below detection in both years and BOD was unchanged. Only NH3 concentration were lower in 1977. Hypolimnion water quality generally improved during 1977 when the lake was mixed. Mean NH3 and BOD concentrations decreased; Mn was unchanged but S concentrations increased. Algal biomass as chlorophyll a was about the same in 1977 as in 1976 (9 micro g/l). Secchi disc depth was also the same. Mean lake transparency ranged from 1.60-1.98 m in 1976 and from 1.62-1.88 m in 1977. Algal blooms did not occur either year. (Danovich-Wisconsin)
W80-03170

POPULATION DYNAMICS AND AGE STRUCTURE OF BOSMINA LONGIROSTRIS IN AN ACID WATER IMPOUNDMENT,
West Virginia Univ., Morgantown. Dept. of Biology.
J. DeCosta, and A. Janicki.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2479-2483, 1978. 3 Fig, 1 Tab, 6 Ref. A-024-WVA(2).

Descriptors: *Population, *Dominant organisms, *Crustaceans, *Acidic waters, *Cheat Lake(WV), Age, Growth rates, Growth stages, Zooplankton, Weight, Bosmina longirostris, Copepods, Biological communities, Acidity, Acid mine water, Impoundments, Biomass, Seasonal, Backwater, Dams, Size, Predation, Competition, Reproduction.

This paper examines seasonal succession of biomass and age structure of Bosmina longirostris populations in acid Cheat Lake, West Virginia and Pennsylvania, and in two less-acidic embayments, May-November 1974. Median surface pH is 4.6 for Cheat Lake and 6.0 in its backwaters. Acid conditions in Cheat Lake are due to mine drainage; data show simple zooplankton communities due to acidification. Extreme Bosmina dominance in the lake suggests that Bosmina has a competitive advantage under more acid conditions. This advantage may be due to high feeding efficiency on a reduced size range of food particles. Lack of Bosmina early dominance in backwaters results from Mesocyclops edax predation. Bosmina becomes increasingly dominant from midsummer to fall especially in lake stations but less so in the two backwaters. Cyclopoids dominates early in the season at lake stations but by September, Bosmina biomass peaks, at nearly 100% Crustacea less nauplii. Biomass dynamics are different at backwater stations. In one area, highest Bosmina biomass occurs in August. However, Bosmina backwater dominance is not so striking due to the presence of M. edax. Early in the growing season, lake populations are composed primarily of large individuals; however, as reproduction rates increase, mean individual weight decreases due to large numbers of smaller individuals. At all lake stations, this low mean weight characterizes the entire summer. However, the population is composed of large individuals by October-November because reproduction rates decrease in autumn. (Danovich-Wisconsin)
W80-03171

PLANKTONIC SYSTEMS AND URBAN POLLUTION: STUDY OF PLANKTON POPULATIONS, (IN FRENCH).
Centre Universitaire de Luminy, Marseille (France). Lab. d'Hydrobiologie Marine.
Oceanologica Acta, Vol 2, No 4, p 379-388, 1979. 35 Fig, 1 Tab, 15 Ref, (English abstract).

Descriptors: *Plankton, *Toxicity, *Sewage effluents, Phytoplankton, Zooplankton, Biological communities, Dominant organisms, Copepods, Outfall sewers, Coasts, Aquatic populations, Bioindicators, Mediterranean Sea, Marseille(France).

This paper describes a study of the distribution of plankton populations in terms of their location with regard to the sewage outfall and of depth. A comparison is made between superficial and underlying populations. In the surface layer, zooplankton density is minimal in the immediate vicinity of the outfall, and increases towards the periphery of the surrounding basin. In the deep layer, the influence of pollution is less pronounced, and neritic zooplankton reaches the shoreline even in the most affected area. With a light wind blowing from the East, three zones may be distinguished. The first of these which is characterized by pronounced turbidity and by high concentrations of carbon, extends to a distance of some 500m from the shoreline, and for more than a kilometer in the immediate vicinity of the outfall; very tolerant zooplankton (Oithona helgolandica, Acartia clausi, Clausocalanus sp., Paracalanus parvus, Oikopleura sp.) and phytoplankton species (Leptocylindus danicus, Nitzschia delicatissima, Rhizosolenia fragilissima) may be observed in this zone. In the second, transitional zone, which is adjacent to the first species found in the most polluted area are more abundant together with others which are more sensitive to pollution (such as the copepods of the family Corycaeidae, Centropage typicus, Temora stylifera etc.). The third, peripheral zone contains the above-mentioned as well as species which are entirely absent in polluted areas and in deep water; the latter include copepods of the Pontellidae family, whose hyponeustonic behaviour is extremely sensitive to pollution, and whose presence would thus suggest that the influence of pollution is insignificant in this zone. (Deal-EIS)
W80-03212

EFFECTS OF DISPERSANT USE ON SHORE LIFE,
University Coll. of Swansea (Wales).
A. Nelson-Smith.
In: Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L. T. McCarthy, Jr., G. P. Lindblom and H. F. Walter, Eds., American Society for Testing and Materials, p 253-265, 1978. 45 Ref.

Descriptors: *Toxicity, *Bioassay, *Oil spills, Oil, Organic compounds, Environmental effects, Aquatic life, Shores, Coasts, Waterbirds, Beaches, Worms, Mollusks, Crustaceans, Plankton, Marine algae, Water pollution control, *Oil dispersants, *Dispersants, Torrey Canyon Spill, England, Milford Haven.

Damage to Cornish seashore life resulting from the chemical dispersal of oil spilled from Torrey Canyon is often taken as typical of dispersant use, although primitive mixtures were badly misapplied there. Where more modern dispersants are used with care, as in recent Milford Haven spills, serious consequences can be avoided. All effective dispersants offer some biological hazards, especially to sedentary or planktonic filter-feeding animals, which are not revealed by short-term acute toxicity testing. Spilled oil should therefore be removed mechanically wherever possible. Careful spraying is recommended to prevent an oil slick reaching the shore and to protect seabird colonies. It may also be necessary on rocky or built-up amenity areas but should be avoided on coasts rarely visited by humans and distant from bird colonies. Spraying may worsen matters on sandy shores, while any form of treatment will further damage oiled salt marshes. (Deal-EIS)
W80-03217

ECOLOGICAL EFFECTS OF DISPERSANTS IN THE UNITED KINGDOM,
Society of Petroleum Industry Biologists, Los Angeles, CA.
For primary bibliographic entry see Field 5B.
W80-03218

IMPACTS OF THERMAL ADDITION AND PREDATION ON INTERTIDAL POPULATIONS OF THE BLUE MUSSEL, MYTILUS EDULIS L.,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
D. Dean.
Proceedings of the National Shellfisheries Association, Vol 69, p 47-53, 1979. 3 Fig, 2 Tab, 27 Ref.

Descriptors: *Mussels, *Mortality, *Heated water, Nuclear powerplants, Cooling waters, Fouling, Entrainment, Thermal effluents, Aquatic populations, Dominant organisms, Crabs, Habitats, Water temperature, Predation, Monitoring.

Populations of the blue mussel, Mytilus edulis, were sampled at four locations on nearly vertical intertidal rocky surfaces from 1970 to 1977. One sampling station was adjacent to the thermal discharge weir of the Maine Yankee Atomic Power Co. electric generating plant, and the other stations were located at increasingly greater distances from the plant. Those mussels adjacent to the weir suffered 100% mortality in less than one year after the plant began operation, and recruitment was not observed even though the means of discharge was changed to a diffuser system during the summer of 1975. Mussel populations at the other three stations declined from several thousand per square meter in 1970 to zero in 1977 although mussels continued to pose a fouling problem within the Maine Yankee plant and on nearby floats. Examination of records of organisms impinged upon the traveling screens of the Maine Yankee plant intake structure revealed a dramatic increase in green crabs, Carcinus maenas, concurrent with the decline of intertidal mussels. During the fall of 1977, an extensive qualitative examination of the rocky intertidal zone revealed that green crabs of many different sizes were very abundant and that mussels were extremely scarce. Floating docks a few meters away were festooned with mussels of several size groups, including the zero age class. The increase in green crab abundance coincided with an increase in the regional surface sea water annual mean temperature. (Deal-EIS)
W80-03219

INITIAL TESTING OF A RECENT BIOLOGICAL MONITORING CONCEPT,
Virginia Polytechnic Institute and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W80-03221

EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON CARBOHYDRATE METABOLISM OF THE LIVER OF TWO BLACK SEA SPECIES OF FISHES,
Akademiya Nauk SSSR, Leningrad. Inst. Evolyutsionnoi Fiziologii i Bokhimii.
For primary bibliographic entry see Field 5B.
W80-03223

CHIRONOMID COMMUNITIES AS WATER QUALITY INDICATORS,
Bergen Univ. (Norway). Dept. of Systematics.
O. A. Saether.
Holarctic Ecology, Vol 2, p 65-74, 1979. 3 Fig, 2 Tab, 26 Ref.

Descriptors: *Mathematical models, *Bioindicators, *Diptera, Methodology, Biological communities, Dominant organisms, Trophic level, Eutrophication, Mesotrophy, Oligotrophy, Phosphorus, Chlorophyll, Oligochaetes, Hypolimnion, Aquatic insects, Arctic, Lakes, Dissolved oxygen, Chlorophylla.

Recent mathematical indices summarizing biological communities of indicators are recapitulated. Improvements of these indices based on weighting according to width of trophic ranges of each species are suggested. Their principle deficiencies, however, are pointed out. Revised lists of characteristic profundal as well as littoral and sublittoral chironomids in Nearctic and Palearctic lakes show that at least 15 characteristic Thcironomid species communities can be delineated, 6 in each of the oligotrophic and the eutrophic ranges and 3 in the mesotrophic range. It is proposed that these communities be lettered consecutively in the Greek alphabet from a(alpha) to o(omikron). A key to the 15 divisions based on the species associations in the profundal zone of harmonic lakes is put forward. There is very good correlation between the 15 divisions and the ratios of average total phosphorus to mean lake depth and average chlorophyll a to mean lake depth. The ratio of chironomids to oligochaetes and the distribution patterns of single species have proven useful in pin-pointing localized areas of pollution. The primary mechanism governing the distribution of chironomid communities in oligotrophic and mesotrophic lakes appears to be the availability of food materials rather than the annual hypolimnetic oxygen concentration. In eutrophic lakes the relationships between organic matter accumulation and oxygen levels are so interdependent as to be inseparable. (Deal-EIS)
W80-03224

MONITORING OF CHLORINATED HYDROCARBONS IN BIOTA OF THE NORTH AND MIDDLE ADRIATIC COASTAL WATERS,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5B.
W80-03226

INFLUENCE OF CERTAIN WASTE WATERS CONTAINING AMMONIA, UREA AND METHANOL ON UNICELLULAR MARINE ALGAE (IN FRENCH),
Institut Romania de Recherches Marines, Constantsa.
For primary bibliographic entry see Field 5A.
W80-03227

LEVELS OF METAL POLLUTANTS IN SEDIMENTS AND BIOTA OF THE GULF OF TRIESTE: A LONG TERM SURVEY,
Trieste Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-03228

POLLUTION MONITORING OF ELEVEN TRACE ELEMENTS IN THREE MARINE ORGANISMS FROM SARONIKOS GULF, GREECE,
Democritus Nuclear Research Center, Athens (Greece). Radioanalytical Lab.
For primary bibliographic entry see Field 5A.
W80-03230

TRACE METALS AND ORGANOCHLORINE RESIDUE CONTENT OF MULLIDAE FAMILY FISHES AND SEDIMENTS IN THE VICINITY OF ERDEMLI (ICEL), TURKEY,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W80-03231

THE IMPACTS OF WASTES FROM A PHOSPHATE PLANT ON THE MARINE ENVIRONMENT (GULF OF GABES, TUNIS) (IN FRENCH),
Institut National Scientifique et Technique d'Oceanographie et de Peche, Tunis (Tunisia). Lab. de Biologie Marine.
For primary bibliographic entry see Field 5B.
W80-03232

TRACE ELEMENTS IN MESOPELAGIC AND SOME COASTAL FISH FROM THE ADRIATIC,
Nuklearni Inst. Jozef Stefan, Ljubljana (Yugoslavia).
For primary bibliographic entry see Field 5A.
W80-03233

STUDY OF THE DYNAMICS OF THE BENTHIC POPULATIONS OF THE BAY OF ALGIERS, PRELIMINARY RESULTS (IN FRENCH),
Centre de Recherches Oceanographiques et des Peches. Algiers (Algeria).
A. Bakalem, and J-C. Romano.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkey, p 335-341, 1979. 7 Tab, 2 Ref, (English abstract).

Descriptors: *Benthos, *Invertebrates, *Water pollution effects, Estuaries, *Domestic wastes, Sewage, Molluscs, Oligochaetes, Diversity index, Algiers, Bay of Algiers, Mediterranean, Seasons.

The dynamics of the benthic populations in the Bay of Algiers has been studied at eleven stations. Preliminary results indicated that the benthic populations are not degraded at the stations close to the effluent pipes. But the influence of the pollution is discernible throughout the bay, especially at depths of less than 20 meters. The changes are most clearly observed during the summer season. Future studies are planned to correlate physical and chemical parameters with the benthic populations. The principal benthic species at the various stations are listed. (Katz-EIS)
W80-03235

MONITORING OF CHLORINATED HYDROCARBONS IN BIOTA AND SEDIMENTS OF SOUTH ADRIATIC COASTAL WATERS,
Biological Inst., Dubrovnik (Yugoslavia).
For primary bibliographic entry see Field 5A.
W80-03238

ACCUMULATION AND DISTRIBUTION OF HEAVY METALS IN SOME MARINE ORGANISMS IN THE BAY OF IZMIR AND IN AEGEAN COASTS,
Ege Univ., Izmir (Turkey). Dept. d'Oceanographique Biologique.
For primary bibliographic entry see Field 5A.
W80-03239

THE EFFECT OF DDT AND HEXACHLORANE ON ASSIMILATION AND OUTFLOW OF 14C IN PHRAGMITES COMMUNIS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-03240

EFFECT OF CHLOROPHOS AND HEXACHLORANE ON CELL CULTURES OF WARM-BLOODED AND COLD-BLOODED ANIMALS,
Odessa State Univ. (USSR).
V. P. Tul'chinskaya, F. S. Zambriborshch, I. I. Fal'kova, S. Y. Dyatlov, and T. V. Mishchenko.
Hydrobiological Journal, Vol 14, No 4, p 80-85, 1978. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Pesticide toxicity, *Cytological studies, Embryonic growth stage, Mode of action, Bioassay, Growth rates, Marine fish, Animal physiology, Animal metabolism, Bioindicators, *Chlorophos, *Hexachlorane.

A study has been made of the effect of pesticides (chlorophos and hexachlorane) on transplantable human RH kidney cells and initially trypsinized cultures of chick embryo fibroblasts and the gonads of the round goby, Neogobius melanostomus. The threshold concentrations exerting a toxic effect on the cells are determined, and the influence of the toxicants on the growth and proliferation of RH cells and on their mitotic activity is established. Data are presented on the comparative sensitivity of cells of the gonads of sea fishes and of members of the family Gobiidae of chlorophos and hexachlorane. In connection with the fairly high sensitivity of the cells of sea fishes to pesticides consideration is given to the possibility of using cell cultures to determine the permissible threshold concentrations of pesticides in commercially exploited items. (Deal-EIS)
W80-03242

CONCENTRATION OF THE HERBICIDE 2,4-D BY SOME HIGHER WATER PLANTS,
Kharkov Vodokanalniiproekt Inst. (USSR).
For primary bibliographic entry see Field 5B.
W80-03243

SOME OBSERVATIONS ON THE REPRODUCTION AND EMBRYONIC DEVELOPMENT OF FIVE SPECIES OF FISH KEPT IN EXPERIMENTAL RADIOACTIVE WATER BODIES,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 5A.
W80-03244

THE EFFECT OF HYPOXIA AND ANOXIA ON THE SPECIES AND NUMBERS OF BLACK SEA POLYCHAETA,
Institute of Biology of the Southern Seas, Odessa (USSR).
G. V. Losovskaya.
Hydrobiological Journal, Vol 14, No 4, p 24-26, 1978. 1 Tab, 7 Ref.

Descriptors: *Bioindicators, *Water pollution, Mussels, Dominant organisms, Biological communities, Benthic fauna, Aquatic populations, Water pollution effects, Oxygen requirements, Biomass, Ecosystems, *Polychaetes, *Black Sea, Hypoxia, Anoxia.

An analysis is given of the species and quantitative development of Polychaeta at the time of succession of a Mytilus galloprovincialis biocoenosis due to hypoxia and suffocation of the benthic fauna. Appreciable changes are noted in these indicators, in particular an increase in the abundance of some eurybiontic detritophages among the Polychaeta species after the oxygen deficit and during restoration of the biocoenosis. These are regarded as 'progressive in relation to pollution'. Based on the author's own data and published data a list is given of those organisms whose abundant development may be an indication of organic pollution. (Deal-EIS)
W80-03246

AN ELECTROMYOGRAM OF THE MANDIBULAR ADDUCTOR OF THE INTACT BAIKAL GRAYLING, THYMALLUS ARCTICUS BAICALENSIS, IN A PHENOL SOLUTION,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Tsellyulozno-Bumazhnoi Promyshlennosti, Leningrad (USSR). Dept. of Ecological Toxicology.
T. A. Karpovich, and B. I. Kolupayev.
Journal of Ichthyology, Vol 18, No 5, p 866-869, 1978. 3 Fig, 9 Ref.

Descriptors: *Phenols, *Toxicity, *Respiration, *Fish physiology, Monitoring, Animal metabolism, Mode of action, Chemical properties, Analytical techniques, *Electromyography, *Grayling, *Thymallus.

The effect of various conditions on mandibular adductor EMG, a measure of respiration, was stud-

ied. A rapid increase in water temperature (2 degrees in 30 min) resulted in increased motor activity and respiratory frequency. When exposed to phenol, the initial (for 5-10 min) reaction of the grayling was a reduction of motor activity. The duration of the respiratory cycles increased. An increase was subsequently observed in motor activity and respiratory rate. The frequency of coughing movements and the total electrical activity increased considerably. The normal regulation of the mandibular adductor was disrupted. This was expressed in the appearance of non-specific biopotentials in the period of bioelectric silence. When exposure to phenol was of short duration these effects were reversible. (Deal-EIS)
W80-03247

THE EFFECT OF CHEMICAL MUTAGENS ON THE SPERMATOZOA OF THE SILVER CARP, HYPOPHTHALMICHTHYS MOLITRIX, AND THE BIGHEAD, ARISTICHTHYS NOBILIS,
Kazakh Research Inst. of Fisheries, Alma-Ata (USSR).
V. V. Kormilin, R. M. Tsoy, Zh. G. Sarsembayev, and N. Ch. Artygaliyev.
Journal of Ichthyology, Vol 18, No 6, p 1030-1033, 1978. 2 Tab, 5 Ref.

Descriptors: *Toxicity, *Fish reproduction, *Organic compounds, Chemical properties, Mode of action, Fish eggs, Growth stages, Embryonic growth, Stage, Animal pathology, Fertility, *Mutagens, *Teratogens.

In this paper results are presented on the influence of groups of chemical mutagens on the spermatozoa of silver carp and bighead, two commercially important species. The following mutagens were used: nitroso-ethyl urea (NEU); nitrosomethyl urea (NMU); nitrosomethyl-biret (NMB); dimethylsulfate (DMS); and 1,4-bis-diasoacetylbutane (DAB). The exposure of ripe spermatozoa to these chemical mutagens did not negatively influence the process of fertilization. In fact, NEU, NMB and DMS have a stimulating effect on the percentage of egg fertilization in silver carp. However, in the bighead, a sharp increase in the number of aberrant embryos was noted. Silver carp spermatozoa proved more resistant to the mutagenic action of these compounds that those of the bighead. (Deal-EIS)
W80-03249

PHYSIOLOGICAL-BIOCHEMICAL DATA ON EXPERIMENTAL INTOXICATION OF FISH WITH 'YALAN',
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-03251

IMPACT OF THE URBAN EFFLUENT OF CORTIOU ON THE NERITIC PHYTOPLANKTON POPULATIONS (IN FRENCH), GROUPE EQUIPE POLLUTION PELAGIQUE DE MARSEILLE (GROUP EPOPEM).
Centre Universitaire de Luminy, Marseille (France). Lab. d'Hydrobiologie Marine.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 371-375, 1979. 3 Fig, 5 Ref. (English abstract).

Descriptors: *Phytoplankton, *Marine algae, *Water pollution effects, Cyanophyta, Euglonophyta, Sewage effluents, Eutrophication, Plant populations, Marseille, Mediterranean, On site investigations, Diatoms.

Two cruises, in spring, and one, in autumn, have been made in Cortiou area (Marseille's sewage outfall). Close to the outfall (about 2 km) the studied area shows photoautotrophic planktonic populations, mainly Cyanophyceae and Euglonophyceae which were abnormal, but afterwards, very quickly, the population system becomes more normal. The very important result is that, even with these particularly eutrophicating conditions, no phytoplankton blooms have been observed. But it could be the consequence of inhibiting action of pollutants contained in the sewage water. (Katz-EIS)
W80-03255

SUB-LETHAL EFFECTS OF THE ORGANOPHOSPHATE BLACK FLY LARVICIDE, ABATE (TEMEPHOS) ON SAROTHERODON MOSSAMBICUS (PETERS),
Centre for Overseas Pest Research, London (England).
R. J. Adeney, and P. Matthiessen.
Journal of Fish Biology, Vol 15, p 545-553, 1979. 5 Tab, 21 Ref.

Descriptors: *Pesticide toxicity, *Cichlids, *Larvicides, Insect control, Fish physiology, Mode of action, Organophosphorus pesticides, Animal metabolism, Chemical properties, Electrolytes, Public health, Human diseases, Vectors(Biological), *Abate, *Temephos, *Tissiue analysis, *Blood chemistry.

Sarotherodon mossambicus was exposed for up to 10 weeks to concentrations of Abate larvicide in excess of those produced during blackfly control in African rivers. Despite this treatment, several indicators of sub-lethal poisoning, e.g. growth, plasma glucose, acetylcholinesterase activity remained almost unchanged. A possible explanation for the low toxicity of Abate may be the fact that AChE inhibition is only caused by the oxygen analogues of Abate and not the parent molecule. (Deal-EIS)
W80-03261

VENTILATION FREQUENCY COMPENSATION RESPONSES OF THREE EURYTHERMAL ESTUARINE FISH EXPOSED TO MODERATE TEMPERATURE INCREASES,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton.
Journal of Fish Biology, Vol 15, p 589-600, 1979. 6 Fig, 2 Tab, 30 Ref.

Descriptors: *Thermal stress, *Fish behavior, *Respiration, Water temperature, Heat resistance, Heated water, Fish physiology, Statistical analysis, Perches, Chesapeake Bay, Seasonal, *Acclimation, *Spot, *Leiostomus, *Hogchoker, *Trinectes, *Ventilation rates.

Ventilation frequency patterns of Trinectes maculatus, Morone americana and Leiostomus xanthurus were used to evaluate potential thermal stress after exposure to moderate temperature increases. Fish acclimated to 5, 15 and 25C were exposed to a 5C Delta T; fish acclimated to 30C were exposed to a 2.5C Delta T. Ventilation frequencies were measured at each acclimation temperature before the fishes were exposed over a 15-min period to the increased temperatures. Ventilation rates were then measured at the elevated temperatures for the next 24h. Significant increases in rate frequency occurred after the temperature increases in T. maculatus and M. americana acclimated to 5, 15, and 25C and in L. xanthurus acclimated to 15, 25, and 30C. In general, rate frequencies increased as the temperature increased. Ventilation rates stablized quickly at the higher temperatures and remained relatively constant throughout the remaining exposure period. Acclimated rate-temperatures curves (R-T curves), acute R-T curves and Q10 temperature coefficients used to assess the significance of the changes in rate frequency and to compare the species in an ecologically meaningful way, showed that several adaptive types occurred among and between species. This suggests that the temperature increases had a negligible effect, that is, little or no thermal stress occurred. (Deal-EIS)
W80-03262

UPTAKE AND CELLULAR DISTRIBUTION OF CADMIUM IN MYTILUS EDULIS,
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
For primary bibliographic entry see Field 5B.
W80-03263

UPTAKE OF HYDROCARBONS BY THE MARINE DIATOM CYCLOTELLA CRYPTICA,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5A.
W80-03267

HEAVY METALS (HG, CD, CU, PB, ZN) IN LIVER AND MUSCLE TISSUE OF FRESHWATER PERCH (PERCA FLUVIATILIS) OF THE LAKE OF BIEL AND THE WALENSEE (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5A.
W80-03269

DIATOMS AND WATER QUALITY IN LOWLAND STREAMS IN THE PROVINCE OF NORTHERN BRABANT (THE NETHERLANDS),
Rijksinstituut voor Natuurbeheer, Leesum (Netherlands).
H. V. Dam.
Hydrobiological Bulletin, Vol 13, No 1, p 13-21, 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Diatoms, Trophic level, Oligotrophy, Mesotrophy, Dominant organisms, Water chemistry, Hydrogen ion concentration, Agricultural wastes, Streams, *Holland.

The diatoms of two Dutch lowland streams were studied. The stream Beerze is heavily polluted by the effluent of a sewage treatment plant, causing a change in the pH from less than 4 to more than 6. The acidobiontic diatom Eunotia exigua is replaced by more alkaline and eutraphentic species such as Gomphonema parvulum, Cyclotella meneghiniana and Fragilaria capucina. The Simpson diversity index rises to 0.2 in the upper course to 0.9 in the middle course and maintains this level on the lower course. From the stream Rosep samples of 1919-1930 and recent ones were studied. This stream is now polluted by agriculture. In the earlier samples oligo-mesotraphentic species dominated (Eunotia spp., Melosira distans). In 1976 the species of organically polluted waters were most abundant. The oligo-mesotraphentic species were hardly recovered. In spite of the severe pollution the number of rare species in both streams is still high, compared with that in stagnant waters. Only in mesotrophic moorland pools and mesotrophic quivering bogs, which are situated in trophic gradients just like both streams, which are situated in trophic gradients just like both streams, a comparable number of rare species may be found. (Deal-EIS)
W80-03275

ACCUMULATION OF CADMIUM BY GREEN MICROALGAE,
Miyazaki Medical Coll. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W80-03276

INFLUENCE OF CRUDE OIL AND DETERGENTS ON THE CONCENTRATION OF SOME IONS IN HEMOLYMPH OF THE SHRIMP CRANGON CRANGON L. AND THE CRAB RHITHROPANOPEUS HARRISI GOULD,
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-03277

PURIFICATION AND PROPERTIES OF SOLUBLE ARYLSULPHATASES ISOLATED FROM HEPATOPANCREAS OF THE SHRIMP CRANGON CRANGON L.
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03278

ACTIVITY OF LIVER FRUCTOSE 1,6 BIPHOSPHATASE IN RAINBOW TROUT HELD IN DIFFERENT CONCENTRATIONS OF INDISSOCIATED AMMONIA (IN ITALIAN),
Genoa Univ. (Italy). Ist. di Zoologio.
For primary bibliographic entry see Field 5B.
W80-03279

ORGANOCHLORINES AND METALS IN HARBOUR SEALS (DUTCH WADDEN SEA),
Netherlands Inst. voor Onderzoek der Zee.
For primary bibliographic entry see Field 5B.
W80-03280

EFFECT OF LONG-TERM LEAD EXPOSURE ON THE SEAWATER AND SEDIMENT BACTERIA FROM HETEROGENEOUS CONTINUOUS FLOW CULTURES,
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.). Dept. of Bacteriology.
For primary bibliographic entry see Field 5A.
W80-03283

EFFECTS OF CRUDE OIL ON THE DEVELOPMENT OF THE SHELL OF MYTILUS EDULIS (L) (MYTILIDAE, BIVALVIA), (IN FRENCH),
Laboratoire de Zoologie, Aquaculture and Pollutions Marines, Brest (France).
For primary bibliographic entry see Field 5B.
W80-03284

LEAD TOXICOSIS AND SALT GLANDS IN DOMESTIC DUCKS,
Pisa Univ. (Italy). Cattedra Patologia Generale Comparata.
For primary bibliographic entry see Field 5B.
W80-03287

TOXIC EFFECTS OF THE PHYTOALKALOID COLCHICINE ON OVIPOSITION AND NEUROSECRETION OF THE VECTOR SNAIL (INDOPLANORBIS EXUSTUS),
Marathwada Univ., Aurangabad, (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03289

EFFECTS OF P,P'-DDT, P,P'-DDD, AND P,P'-DDE ON OXYGEN UPTAKE IN THE FRESHWATER PLANARIAN (PHAGOGATA GRACILIS),
Middle Tennessee State Univ., Murfreesboro.
For primary bibliographic entry see Field 5A.
W80-03291

EFFECT OF AMMONIUM CHLORIDE ON PREDATORY CONSUMPTION RATES OF BROOK TROUT (SALVELINUS FONTINALIS) ON JUVENILE CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA) IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
J. L. Hedtke, and L. A. Norris.
Bulletin of Environmental Contamination & Toxicology, Vol 24, p 81-89, 1980. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Ammonia, *Toxicity, *Fish behavior, *Research equipment, Methodology, Analytical techniques, Chlorides, Salmonids, Brook trout, Chinook salmon, Predation, Fish populations.

The present study was undertaken to (1) devise an experimental apparatus to permit study of the impact of ammonia on predator-prey interactions involving salmonid fishes in a flowing water system and (2) quantify the effects of sublethal levels of ammonia in this system. This report describes the apparatus and the influence of ammonium chloride on consumption of salmon fry by trout in laboratory streams. The system was found to be useful in monitoring chloride on consumption of salmon fry by trout in laboratory streams. The system was found to be useful in monitoring the effects of ammonium chloride on the baseline predator-prey interactions. The predator consumption rates were either depressed or elevated, depending on the concentration of NH3 and the density of the prey. Other types of organism responses like territorial responses, courtship or breeding responses, and food utilization are examples of effects which may be influenced by sublethal exposure to environmental contaminants and which could be tested in this type of system. (Deal-EIS)
W80-03292

SELENIUM TOXICITY TO DAPHNIA MAGNA, HYALLELA AZTECA, AND THE FATHEAD MINNOW IN HARD WATER,
Michigan State Univ., East Lansing. Pesticide Research Center.
For primary bibliographic entry see Field 5A.
W80-03294

HYDROIDS IN BIOTEST: CLAVA MULTICORNIS EXPOSED TO CADMIUM,
Kiel Univ. (Germany, F.R.). Inst fuer Meereskunde.
For primary bibliographic entry see Field 5A.
W80-03296

TOXIC EFFECTS AND ACCUMULATION OF CADMIUM IN SOME BENTHIC ORGANISMS OF THE BALTIC,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5A.
W80-03297

REVIEW OF EXPERIMENTS ON THE CHRONIC TOXICITY EXERTED BY SOME POLLUTANTS ON ANIMAL SPECIES FROM THE BAY OF GDANSK,
Akademia Medyczna, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03298

5D. Waste Treatment Processes

SAND FILTRATION OF OXIDATION POND EFFLUENT FOR REUSE IN PARK IRRIGATION,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
D. Kasper, R. Phillips, R. Sierka, and N. Myers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140098, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Tucson, Project Completion Report, January 1980, 64 p, 28 Fig, 7 Tab, 11 Ref. OWRT A-052-ARIZ(1), 14-31-0001-5003.

Descriptors: *Water reuse, *Oxidation pond effluent, *Water pollution treatment, Sand filtration, Irrigation water, Algae filtration, Oxidation pond reuse.

This study is an investigation of intermittent sand filtration of oxidation pond effluent utilizing local river bed sands as filter media. The only related research utilizing oxidation pond effluent was a laboratory and field scale study conducted at Utah State University. The experimental set-up for this investigation consisted of several laboratory scale filter columns filled with local river bed sands. These columns were dosed at a selected rate and sequence with oxidation pond effluent. The parameters investigated included depth, dosing sequence, and hydraulic loading rate. Reproducibility and the effects of column diameter were also investigated to insure the validity of results. The results of the quality parameters investigated, including COD, volatile and total suspended solids, turbidity and algae concentration, were evaluated statistically. Findings included the following: (1) A slight improvement in filtrate quality occurred in the smaller diameter columns. (2) Filtrate quality improved significantly with increasing filter depth. (3) Only slight differences in filtrate quality were found for filters operated on three and four day dosing cycles. (4) Filtrate quality deteriorated with increased hydraulic loading rates. (5) Continuous operation of filters resulted in clogging.
W80-03004

ALTERNATIVES FOR WASTEWATER TREATMENT IN RURAL AREAS,
Maine Univ. at Orono. Dept. of Civil Engineering.
F. E. Woodard.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 73-87. 7 Fig, 8 Ref.

Descriptors: *Rural areas, *Alternative planning, *Disposal, *Waste water treatment, Water quality, Groundwater, Discharge(Water), Costs, Waste water disposal, Surface waters, Absorption, Sewage lagoons, Sewage treatment, Sewage, Water pollution treatment, Activated sludge, Septic tanks.

Design of wastewater treatment processes should be compatible with the final disposal site, assuming either groundwater or a surface water body. Treatment before discharge to surface waters requires complete removal of solids, biodegradable organic material (BOD) and infectious agents (disinfection). Any additional material which pollutes the water, such as color, heavy metals, or other toxic material, must also be removed. This can be accomplished by using a package plant, septic tank and sand filter system, or lagoon or stabilization basin followed by sand filters. Package plants are small activated sludge type treatment systems. Lagoons and stabilization basins are ponds in which wastewater is held for a few days to several months. Suspended solids and oxidizable materials are removed by bioflocculation, sedimentation, oxidation, and reduction. With groundwater disposal, the ground itself is the primary treatment medium. A septic tank pretreats wastewater before it is applied to the ground in order to prolong the life of the disposal site. The basic ground application system is the absorption trench. Bed and chamber systems overcome problems with low soil permeability. The mound system overcomes problems of shallow depth to an impermeable stratum and high groundwater tables. Costs vary greatly with size and construction type. Generally, the least expensive system in favorable soil is a septic tank-absorption trench. (See also W78-11244) (Danovich-Wisconsin)
W80-03131

DESIGN OF A SUBSURFACE WASTE DISPOSAL SYSTEM WITH BIOLOGICAL DENITRIFICATION,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. Laak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140056, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 20 p, 6 Tab, 2 Fig, 27 Ref. OWRT A-062-CONN(1), 14-34-0001-9007.

Descriptors: *Denitrification, *Waste water treatment, *Design, Waste disposal system, Methodology, Greywater, Carbon source, *Septic tank effluent.

Nitrogen was removed from septic tank effluent in a nitrification-denitrification system, using greywater as the organic carbon source in the denitrification step. A preliminary study showed greywater from a typical home contained abundant soluble carbon that biodegraded at the same rate as methanol, which, until this study, appeared to be the most promising source of organic carbon for such a system. A second laboratory study used aerobic sand column reactors to nitrify unfiltered septic tank effluent, and fixed media columns consisting of stones dimensionally similar to those used in conventional trickling filters to denitrify the waste. Greywater, settled sewage, and methanol were added prior to the denitrification step to determine their suitability as possible sources of organic carbon. Greywater removed 71% of the available nitrate, methanol removed 83%, and set-

tled sewage removed 4.3%. A field demonstration model was then built, using an aerobic subsurface sand filter bed for blackwater nitrification and an anoxic denitrification reactor based on a five day liquid detention time. Some of the greywater from the household acted as the carbon source for denitrification, removing up to 99% of the available nitrate. It was concluded that greywater is an acceptable carbon source for denitrification.
W80-03174

APPARATUS FOR TREATING METAL CONTAINING WASTE WATERS,
Gotzelmann KG Industrieabwasser-Anlagen, Stuttgart (Germany, F.R.). (Assignee).
R. Kammel, and H-W. Lieber.
U.S. Patent No 4,172,780, 10 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1209, October 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, *Metals, Electrolysis, Cathodes, Anodes, Vibrations, Equipment, Product recovery.

A method for treating metal containing waste water employes a vessel containing the waste water in which there is provided at least one anode and a cathode comprised of electrically conductive elements. The waste water is subjected to electrolysis during which the cathode elements are moved. The cathode elements are provided in the form of rods which are arranged in the vessel by means of at least two holding devices so that the rods extend parallel to one another and can be moved in the holding devices relative to one another. The holding devices are moved during electrolysis so that the rods strike one another again and again at spaced intervals. Since the rods of the cathode strike one another again and again, the deposited layers of metal are continuously separated from the rods so that continuous operation is assured. The relatively few heavy metal rods can be guided in space with great accuracy. It is thus possible to make electrical contacts by means of current leads having a small contacting surface and high areal compressions which results in very low transfer resistance and thus a low voltage requirement. Furthermore the anodes can be brought very close to the cathode. This results in low energy requirements and consequently relatively little heating of the electrolyte. (Sinha-OEIS)
W80-03265

WASTE WATER PROCESS FOR TREATMENT OF STRONG WASTES,
Standard Oil Co. (Indiana), Chicago, IL. (Assignee).
J. D. Walk, J. F. Grutsch, and R. C. Mallatt.
U.S. Patent No 4,172,781, 10 p, 1 Fig; 15 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1209, October 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, Separation techniques, Aeration, Activated sludge, Activated carbon, Oxygenation, Powdered carbon.

A waste water process for the treatment of strong wastes is disclosed. Generally the process comprises an activated sludge process for the purfication of waste water comprising: feeding the waste water to a first aeration zone where oxygen is introduced, and the waste water is contracted with activated sludge; passing the effluent from the first aeration zone to a first clarification zone to separate suspended sludge particles from partially decontaminated water; recycling a portion of the separated sludge and passing the partially decontaminated water from the first clarification zone to a second aeration zone; adding about 5 to about 500 ppm powered activated carbon to the partially decontaminated water; oxygenating the water containing carbon; passing the effluent from the second aeration zone to a second clarification zone to separate suspended sludge and carbon particles; and recycling a portion of the separated sludge and carbon and passing the decontaminated water out. (Sinha-OEIS)
W80-03266

PROCESS FOR THE SEPARATION OF CADMIUM (CD++) IONS FROM SEWAGE, WASTE WATER AND AQUEOUS SOLUTIONS,
Deutsche Gold- und Silber-Scheideanstalt A.G., Frankfurt am Main (Germany, F.R.).
H. Knorre, G. Pohl, and K. Stutzel.
U.S. Patent No 4,172,784, 4 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1210, October 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Industrial wastes, Cadmium, Separation techniques, Chemical precipitation.

Cadmium (Cd++) ions are separated from an effluent containing complexing agent such as nitrilotriacetic acid, ethylenediamine tetraacetic acid and/or diethylenetriamine pentaacetic acid, or their anionic salts by using an HS-containing triazine compound and Fe+++ ions in a quantity at least equal to the amount of complexing agent. (Sinha-OEIS)
W80-03270

OUTLET FOR SEPTIC TANKS,
C. V. Perry, Jr.
U.S. Patent No 4,172,799, 7 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1215-1216, October 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Septic tanks, Pollution abatement, Soil disposal fields, Equipment.

A septic tank has an improved outlet which may be readily installed in existing septic tanks without modification of the tank or outlet fittings, to prevent the discharge of particles of sewage suspended in the effluent from passing directly into the drain field. The outlet includes a 'T', a dual conic deflector composed of two cones jointed at their bases and flexibly supported directly below the open lower end of the 'T'. Effluent containing solid particles rising from the bottom of the tank during the fermentation process is deflected. The flexible mounting permits sidewise displacement of the conic deflector so that the upright portion of the 'T' can be reamed to remove any accumulation of deposits. The conic deflector is weighted so as to return to its original position after the reaming operation has been completed. (Sinha-OEIS)
W80-03273

METHOD FOR THE SEPARATION FROM EACH OTHER OF THE COMPONENTS OF A MIXTURE OF WATER, OIL AND DIRT (SLUDGE) AS WELL AS APPARATUS FOR PERFORMING SAID METHOD,
H. J. Ankersmit.
U.S. Patent No 4,176,068, 7 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1052-1053, November 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Oil pollution, Oily water, Sludge, Flow separation, Equipment, Ballast water.

A method and apparatus is described for separating into components a mixture of water, oil and sludge. The mixture is poured out of a downwardly-directed conduit onto the upper surface of a conically-shaped chamber having a discharge flow capacity at its lower end corresponding to the sludge volume content of the mixture. The oil and water are drawn off and conducted to a chamber formed at the lower surface of the conically-shaped chamber upon which the mixture was initially discharged. One or more filters are provided at the bottom portions of the second chamber to separate the oil and water. By continuously discharging heavy components from the narrow portion of the chamber, separation takes place between heavy components and lighter components. The lightest component (the oil) will rise as far as possible and form a layer which is continuously discharged, while a quantity of mixture formed by light components (water, oil and light sludge) will collect between the upper side of the chamber and it is continuously discharged to undergo a further separating treatment. (Sinha-OEIS)
W80-03274

GRAVITATIONAL FLOW SEPARATOR OF THE MULTIPLE, APERTURED TUBE TYPE FOR SEPARATING WATER FROM SAND, GRAVEL OR THE LIKE,
A. H. Sloan.
U.S. Patent No 4,176,066, 7 p, 10 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1052, November 27, 1979.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Separation techniques, Sands, Coarse sediments, Storm drains, Flow separation, Equipment, Construction equipment.

A dewatering separator device for separating solid particles such as sand, gravel, or the like from water, preconditions the water either for further filtering elsewhere or for permitting the water to be accepted in storm drains. The separator device is of the gravitational flow type and includes vertically arranged tubes, each of which has small apertures in the form of thin slits in their side walls. The mixture of solid material, i.e., sand, gravel, etc. and water is dumped through the top of the tubes, causing the heavier solid material to pass through the tubes where it is collected in a constituent trap, and from which the material is periodically discharged at one location. The water passes through the small slits in the sidewalls of the tubes and is discharged. The device has a movable support to render it portable for transport to different job sites. (Sinha-OEIS)
W80-03281

5E. Ultimate Disposal Of Wastes

MEASURING THE RISKS OF WASTE DISPOSAL BY DEEP-WELL INJECTION,
Marquette Univ., Milwaukee, WI.
For primary bibliographic entry see Field 6B.
W80-03005

A STUDY OF THE EFFICIENCY OF SEPTIC TANK EFFLUENT TREATMENT IN TWO RAISED BED SYSTEMS,
Maine Univ. at Orono. Dept. of Civil Engineering.
G. S. Nault.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140189, Price codes: A09 in paper copy, A01 in microfiche. MS thesis August 1979. 187 p, 85 Fig, 38 Tab, 22 Ref, 1 Append, OWRT A-040-ME(2).

Descriptors: *Sewage treatment, *Septic tanks, *Waste water disposal, Environmental sanitation, Soil moisture, Soil physical properties, Sands, Clays, Chemical oxygen demand, Biochemical oxygen demand, Ammonia, Coliforms, Nitrogen, Water table, Maine, Raised beds, Mound systems.

Two raised bed systems for distribution of septic tank effluent located in Orono, Maine, on soils not suitable for conventional septic tank soil absorption systems were studied to determine treatment performance under given trench and site conditions. The two 'mound' systems were installed at private homes and chemical, physical, and biological parameters were monitored during 1978 and 1979. The first system, built according to the Maine State Plumbing Code, was a large 125 ft by 44 ft mound with the bottom of the absorption trench located 4 ft below the top of the mound. The 75 ft trench was 1 ft deep and 5 ft wide running east to west. The second system used less sand and had a pumping system for effluent distribution. It was 45 ft by 100 ft with 6 absorption trenches 3 ft wide by 1 ft deep and 29 ft long with an overall mound height of 3 ft. Sand fill for both mounds came from the same pit. Marine clay barriers were used to seal the mounds. Parameters monitored include; soil moisture, chemical oxygen demand, biochemical oxygen demand, ammonia nitrogen, organic nitrogen, nitrate nitrogen, chloride, coliforms, water level, and flow. Results show that groundwater table location in relation to the sand fill is a dominant factor in treatment efficiency. Sand fill treatment efficiency decreased as saturation conditions

increased. Marine clay was found to be an effective treatment medium given effective pretreatment and distribution of septic tank effluent. Neither system showed signs of freezing in winter although lower temperatures did decrease sand fill treatment efficiency. (Seigler-IPA)
W80-03085

ENVIRONMENTAL INFLUENCES ON THE DEVELOPMENT OF OIL-DECOMPOSING MICROORGANISMS,
Northern Research Inst. of Hydraulic Engineering and Land Reclamation, Kazan Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
N. V. Morozov, and V. N. Nikolayev.
Hydrobiological Journal, Vol 14, No 4, p 47-53, 1978. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Microbial degradation, *Oil, *Water temperature, Hydrogen ion concentration, Oxidation, Bacteria, Nitrogen, Phosphorus, Metabolism, Pseudomonas, Respiration, Growth rates, Oxygen requirements.

Oil-decomposing microorganisms are shown to be highly biologically active in the purification of water from oil in the range pH 5-9. Temperatures of 20-28C are conducive to their development, but they also grow intensively and maintain a high rate of oxidation of oil at low temperature (6-8C). Readily oxidizable organic matter and biogenous elements in the form of ammonium salts of nitrogen and phosphorus must be added to the medium to maintain the physiological activity of the microorganisms. (Deal-EIS)
W80-03245

5F. Water Treatment and Quality Alteration

POLYMERS FOR PREVENTING AND REMOVING SCALE IN BOILERS,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
K. G. Phillips, and J. F. Kneller.
U.S. Patent No 4,171,988, 4 p, 1 Tab, 1 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 937, October 23, 1979.

Descriptors: *Patents, *Water treatment, *Industrial water, Demineralization, Scaling, Hardness(Water), Boiler feed water, Heated water, Chemical reactions, Descaling, Polymers.

Water-soluble ampholytic polymers formed by reacting chloroacetic acid with a cationic polymer formed by reacting epichlorohydrin and ammonia are effective in removing and inhibiting calcium formation in boilers under conditions in which steam is generated under pressures ringing from 15 p.s.i. up to about 1500 p.s.i. The ampholytic polymers may be added either to the boiler feedwater or directly to the water in the boiler where the steam is generated. To accomplish close additive control, the polymers are added in aqueous solution form wherein the active ingredient comprises from about 10% up to the maximum of solubility of the polymer in water. An alkaline material may be required to adjust the boiler water to within the desired pH range. (Sinha-OEIS)
W80-03103

POLYPHOSPHATE-BASED INDUSTRIAL COOLING WATER TREATMENT,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
G. T. Farley.
U.S. Patent No 4,172,032, 9 p, 6 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 952, October 23, 1979.

Descriptors: *Patents, *Water treatment, *Cooling water, *Industrial water, Scaling, Corrosion, Chemical reactions, Polyphosphates.

When a specific condensed phosphate glass is combined with an organic phosphate ester, an improved composition is afforded for preventing scale and corrosion in industrial cooling systems. Optionally, certain azoles are combined with the phosphate glass and phosphate ester to afford protection to non-ferrous metals. (Sinha-OEIS)
W80-03139

OZONATION OF COOLING TOWER WATERS,
M. F. Humphrey, K. R. French, and R. D. Howe.
U.S. Patent No 4,172,786, 5 p, 1 Fig, 1 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1211, October 30, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Industrial water, Cooling water, Scaling, Corrosion, Ozone.

Continuous ozone injection into water circulating between a cooling tower and heat exchanger with heavy scale deposits inhibits formation of further deposits, promotes flaking of existing deposits, inhibits chemical corrosion and controls algae and bacteria. (Sinha-OEIS)
W80-03271

WATER PURIFIER APPARATUS,
Teledyne Industries, Inc., Ft. Collins, CO. (Assignee).
For primary bibliographic entry see Field 5G.
W80-03272

5G. Water Quality Control

METHOD FOR PREVENTING THE CONTAMINATION OF SUBSOIL WATER FROM PRODUCTS DEPOSITED ON THE GROUND OR IN UNDERGROUND CAVITIES,
C. O. Morfeldt.
US Patent No 4,171,921, 6 p, 3 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 914, October 23, 1979.

Descriptors: *Patents, *Subsurface water, *Water quality control, Water pollution control, Pollution abatement, Underground structures, Tunnels, Sinks, Water levels, Flow, Velocity.

A method for preventing the contamination of subsoil water by harmful substances which originate from an object at or near ground level is described. A tunnel having a water permeable wall is formed below the natural water level to thus form a sink funnel in the subsoil. The accumulated water in the tunnel is drained away quickly enough so that the velocity of water movement toward the tunnel exceeds the water velocity in all other directions. (Sinha - OEIS)
W80-03025

OUTDOOR ALGAL MASS CULTURES--I. APPLICATIONS,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Water Research, Vol 13, No 1, p 1-19, 1979. 10 Fig, 1 Tab, 111 Ref. U.S. Dept. of Energy EG-77-S-02-4151.

Descriptors: *Algae, *Photosynthesis, *Cultures, *Technology, Waste water treatment, Production, Universities, Energy, Solar energy, Mass, Research priorities, Resource development, Application methods, Engineering, Research and development, Proteins, Foods, Food processing industry, Chemicals, Nutrients, Recycling.

Traditional and new applications for outdoor algal mass cultures are discussed. Early efforts were directed towards single-celled protein production for human consumption; however, many new applications have evolved including wastewater treatment, water renovation, nutrient recycling, chemical production, aquaculture, and bioconversion of solar energy. Mass algal culturing problems relate to culture mixing, nutrient availability and addition, species control, CO2 addition, water supply and evaporation and algal separation and harvesting. Algal yields up to 30-40 g dwt/sq m d have been reached for short time periods and yields between 15-25 g dwt/sq m d for longer periods are now common. Algal mass culturing on a large-scale is not a feasible solution for protein production or solar energy conversion, however, the process has high potential in wastewater treatment, aquaculture, and as a source of certain chemicals such as glycerol. Recent works of Oswald at Berkeley, Ryther at Woods Hole, and Shelef in Israel, show that algal systems have great versatility for solving environmental problems, particulary when designed as integrated-multi-use systems for wastewater treatment, water renovation, nutrient recycling and animal protein feeding. (Danovich-Wisconsin)
W80-03105

FLOATING OIL SKIMMER,
D. E. Morris.
U.S. Patent No 4,172,036, 6 p, 5 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 953, October 23, 1979.

Descriptors: *Patents, *Oil pollution, *Water quality control, *Separation techniques, Skimming, Floating, Equipment, Oil recovery.

An apparatus for removing oil floating on water comprises buoyant means for floating the apparatus and at least one set of rotatable discs having spaced apart, generally parallel, vertically oriented discs. Each disc has an outer edge and generally collinear centers. The sets of disc are mounted on the buoyant means so that the discs are partly submerged. A drive means rotates the discs so that oil floating on the water adheres to the discs and is moved away from the water surface as the discs rotate. The oil adhering to the discs is removed and directed to a storage location. Preferably, the apparatus has three sides and three corners, one set of discs being mounted along each side in a triangular arrangement. (Sinha-OEIS)
W80-03143

GROUND-WATER SALINITY PROBLEMS RELATED TO IRRIGATION IN THE COLORADO RIVER BASIN,
Tennessee Valley Authority, Norris, TN. Office of Natural Resources.
M. T. El-Ashry.
Ground Water, Vol 18, No 1, p 37-45, January-February 1980. 8 Fig, 4 Tab, 23 Ref.

Descriptors: *Salinity, *Groundwater, *Irrigation, *Colorado River Basin, Saline water, Salts, Water quality, Water quality control, Leaching, Aquifers, Irrigation water, Irrigation practices, Irrigation operation and maintenance, Irrigation effects, Agriculture.

The groundwater system in many of the irrigated areas of the Colorado River Basin is derived almost entirely from deep percolation of irrigation water and seepage from irrigation conveyance and tailwater collection systems. Salt pickup rates from irrigated soils in the basin vary in the different areas. Among the high salt pickup areas is the Grand Valley in western Colorado, estimated at 8 tons/acre/year. Water entering the groundwater supply from irrigation practices in the valley amounts to about 145,000 acre-feet/year and contributes about 690,000 tons/year to the salt load of the Colorado River. Samples of base-flow water from the weathered Mancos Shale aquifer in the valley vary in salinity from about 1,500 to about 9,000 mg/l with a mean of 4,100 mg/l; while water samples from alluvial aquifers range from 305 to 124,000 mg/l with a mean of about 11,500 mg/l. Base-flow returning to the river in the drains and washes has concentrations that average about 4,200 mg/l. Water losses and quantities of irrigation return flows can be reduced by improving farm irrigation efficiencies and by partial or complete lining of canals, laterals, and ditches. Increasing on-farm irrigation efficiency through system improvements and irrigation scheduling is the most cost-effective measure. However, achievement of higher efficiencies will require changes in water laws to encourage conservation and revised water pricing policies that discourage waste. (Sims-ISWS)
W80-03189

OZONATION OF COOLING TOWER WATERS,
For primary bibliographic entry see Field 5F.
W80-03271

WATER PURIFIER APPARATUS,
Teledyne Industries, Inc., Ft. Collins, CO. (Assignee).
T. E. Corder.
U.S. Patent No 4,172,796, 10 p, 13 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1214-1215, October 30, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, Filtration, Domestic water, Filters, Valves, Taste, Odor, Filter cartridges.

A water purification device includes a housing having a base portion and a generally-cylindrical cup-shaped cap removable secured to it. An input fluid channel in the base portion communicates with one end of the chamber defined by the cup and an outlet fluid channel communicates with that chamber end. A filter cartridge placed within the cap has a conduit that extends between its opposite end walls. Filter material surrounds the conduit. An inlet opening in the cartridge is positioned to communicate with the input fluid channel so as to permit water to flow through the filter material. An outlet opening in the cartridge is arranged to communicate from the filter material to the other end. A valve is included in an extension of the base portion in order to selectively control the distribution of water. The valve itself has a bore and a corresponding stem which are longitudinally tapered. (Sinha-OEIS)
W80-03272

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

TOWARDS A DEFINITION OF DROUGHT,
Ministry of Overseas Development, London (England).
S. Sandford.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 33-40, 1979. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Droughts, *Water shortage, *Analytical techniques, *Botswana, Regional analysis, Planning, Probability.

Although people tend to define drought in ways that best suit their needs, there are occasions such as insurance, government legislation, regulations, planning, prediction, etc., when a precise definition is required. A logical concept of drought as a rainfall-induced shortage between the supply of a good and the requirements for that good, is developed here that incorporates several additional useful elements and one which can be extended to yield useful practical results for policy makers in terms of rough quantitative estimages of the effects of different degrees of severity. Such a quantitative application of the concept is illustrated here for livestock feed in Botswana in which the probabilities of drought of given degrees of severity occurring in different regions are calculated. (Tickes-Arizona)
W80-03060

BOTSWANA'S PRESENT CLIMATE AND THE EVIDENCE FOR PAST CHANGE,
University Coll. of Botswana, Gaborone. Dept. of Geography.
H. J. Cooke.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 53-58, 1979. 15 Ref.

Descriptors: *Weather forecasting, *Paleoclimatology, *Environmental effects, *Botswana, *Decision making, Variability, Rainfall, Agroclimatology, Africa.

Botswana's climate, determined principally by its position in the center of southern Africa and its latitudinal position, is unreliable and therefore marginal. This review of this largely arid country's present climate and the evidence for past climatic change indicates that (1) in southern Africa, including Botswana, there is strong statistical likelihood of below-average rainfall in the next decade, (2) the earth appears to be entering a period of greater climatic variability, and (3) pressure on Botswana's already fragile ecosystem is heavier than ever before. On this basis it is concluded that if the effects of fluctuations in atmospheric circulation are not generally understood, agricultural productivity will become less stable, centralized systems will become more vulnerable, and there will be greater need to insulate communities. Information regarding the impact of climatic variability on human activities is essential to government decisions. (Tickes-Arizona)
W80-03062

AUSTRALIAN DROUGHT WATCH SYSTEM,
Bureau of Meteorology, Melbourne (Australia).
D. M. Lee.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collabration with Clark University Press. p 173-208, 1979. 21 Fig, 9 Tab, 1 Ref.

Descriptors: *Forecasting, *Droughts, *Meteorological data, *Monitoring, Australia, Computer programs, Rainfall, Data transmission.

Operation of a computerized drought alert system introduced by the Bureau of Meteorology in Australia in 1974 to remove subjectivity from the selection of analysis areas, and to speed up the publication of the Drought Review, is described here in detail. The System, based on the monthly rainfall totals of some 800 selected stations telegraphically reporting throughout Australia over a period of at least 40 years is compared to the previous manual method for the 1972 Australian drought, with an example of its application to Mahalapye in Botswana. It is concluded that this newer computerized system enables a better delineation of areas of rainfall deficiencies than was apreviously available under a subjective system. By performing many of the calculations prior to the end of the month, it is now possible to make probability statements about the state of rainfall deficiencies that will exist some three weeks into the future, and it is hoped that the system, when applied worldwide, would establish an alerting and advisory approach on a routine objective basis for areas where there is concern for rainfall deficiencies. (Tickes-Arizona)
W80-03072

AN ASPECT OF WARNING SYSTEMS FOR DROUGHT: INFORMATION COLLECTING IN THE DISTRICTS,
Botswana Ministry of Local Government and Lands, Gaborone.
E. Wily.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone, Published by the Botswana Society in collaboration with Clark University Press. p 211-218, 1979. 3 Ref.

Descriptors: *Droughts, *Forecasting, *Botswana, *Comprehensive planning, Project post-evaluation, Monitoring, Local governments.

Over the last 12 months, the Ministry of Local Government and Lands of Botswana has actively pursued a strategy of decentralized planning, enabling districts to formulate their own immediate as well as five-year plans for incorporation in the overall Fifth National Development Plan (1979-1985). The Drought Committee has further recommended that districts individually devise procedures for monitoring drought conditions or indications, and associated procedures for implementing drought relief for which they will be responsible. It is the purpose of this paper to elucidate the guidelines or framework by which the individual districts are to carry out this task and to document how far this particular element of drought planning has progressed over the past twelve months. Water-related elements include rainfall, livestock water supplies, and grazing conditions. Not all districts have yet complied with the Ministry's request for the establishment of a drought warning system, but procedures presented by five districts in compliance are reviewed here. (Tickes-Arizona)
W80-03073

DROUGHT AND ARABLE FARMING,
Botswana Ministry of Agriculture, Gaborone.
D. B. Jones.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 234-239, 1979. 2 Fig, 9 Ref.

Descriptors: *Droughts, *Livestock, *Future planning(Projected), *Arable land, Farm management, Administration, Botswana, Seeds.

Although drought in Botswana is often thought of in terms of its effects on livestock and ranges, more general considerations indicate that arable and livestock droughts frequently exhibit both temporal and economic differences. While pointing out that this comparison of the pure pastoralist with the pure arable farmer is somewhat academic, since most Botswana farming households are involved in mixed farming, it is emphasized here that there are strong ties between the two enterprises and that a failure in one will often cause a serious problem in the other. A conjectural look at the recovery of arable agriculture indicates that the government needs to be far more concerned with the problem of multi-year drought than single season drought, regardless of whether these are arable only or arable-plus-livestock droughts. Some suggestions of possible measures to assist post-drought recovery are offered and discussed in terms of policy implications, including seed storage for use in times of drought-induced shortages, and contract ploughing. The author presents these as preliminary ideas only, and urges greater official consideration of not only these but other options as well. (Tickes-Arizona)
W80-03074

THE TRIBAL GRAZING LAND POLICY'S RELEVANCE IN A DROUGHT-PRONE ENVIRONMENT,
International Livestock Centre for Africa, Addis Ababa (Ethiopia).
R. R. Von Kaufmann.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with the Clark University Press. p 255-260, 1979. 2 Fig, 9 Ref.

Descriptors: *Droughts, *Grazing, *Pasture management, *Botswana, *Water allocation(Policy), Equitable apportionment, Comprehensive planning.

Botswana's Tribal Grazing Land Policy (TGLP), an open and comprehensive land reform program, is analyzed here in terms of its relevance in a drought-prone environment where the unregulated development of water sources by individuals who tend to dominate the use of surrounding tribal lands has been curtailed. Recognizing that the present common ownership of land forces individuals to maximize their private wealth in livestock at the expense of the commonwealth of rangeland, the hypothesis of the TGLP is that creation of smaller, more manageable land units with which individuals can identify, is the best most equitable way of generating a proprietary interest in long-term husbandry of range resources. While no conclusions about the relevance of this policy can be drawn yet, it is assumed that if this reform continues to move in the direction of providing manageable farming units with control over defined land areas accompanied by a move towards more sophisticated technology, it will be highly relevant to drought recovery. (Tickes-Arizona)
W80-03075

A PROCESS FOR COMMUNITY FLOOD PLAIN MANAGEMENT.
Leman Powell Associates, Inc. Alexandria, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135296, Price codes: A06 in paper copy, A01 in microfiche. Office of Water Research and Technology Planning Manual OWRT TT/79 9, November 1979. 121 p, 8 Fig, 7 Tab, 27 Ref, 5 Append. OWRT T-0008(6707)(1), 14-34-0001-6707.

Descriptors: *Flood plains, *Flood control, *Planning, *Management, Flood damage, Design flood, Flood protection, Flooding, Flood plain zoning, Floodways, River flow, Flood stages, Legal aspects, Flood plain insurance, Risks.

Guidelines for the process of preparation and management of plans for the reduction and avoidance of flood damage in flood plain areas are presented. Flood plain management is the combination of appropriate measures to deal with a flooding problem in a particular area. These measures may be structural (dams, levees, floodwalls, diversions, and channel improvements) or nonstructural (land use regulations and zoning). An initial planning step is the evaluation of the flood plain to identify and delineate the area. Three types of land subject to flooding are riverine flood plains, coastal flood plains, and especial flood plain areas such as shallow flooding areas, wetlands, and sinkholes. Aspects to be included in an evaluation include economic, social, political and organizational, and environmental. Suggested evaluation processes are summarized. The general planning process is described along with a review of the variety of means and tools available for flood plain management implementation. Other management planning information provided includes legal framework, and technical and financial assistance available. Finally the process for bringing together all the aspects of planning is described and an example is given. (Seigler-IPA)
W80-03079

MANAGEMENT OF WATER RESOURCES - A CO-OPERATIVE GAME-THEORETIC APPROACH TO INTER-STATE PROBLEMS,
P. K. Rao.
ASCI Journal of Management, Vol 8, No 1, p 1-13, September 1978. 1 Tab.

Descriptors: *Simulation analysis, *India, *Water allocation(Policy), *Federal-state water rights conflicts, *Administrative agencies, Systems analysis, Equitable apportionment, Cost-benefit analysis, Economics, Cost sharing, Political constraints, Institutional constraints, Japan, Water resources development, Regulation, Federal government, U.S. Water Resources Council, State governments, Water rights.

An analytical methodology based on cooperative game theory, previously reported from a water resources system case study in Japan, is tested for equitable of costs and benefits of interstate water allocation in India. The study also discusses the potential for greater utilization of water resources in India, reviews political and administrative historical highlights of federal-state and interstate water resources management characteristics in that country, and calls for establishment of an Indian national water resources council. The methodology adapted from Mitsuosuzuki and Mikonakayama (1976) fixes fair distribution of costs and benefits as a linear programming problem involving calculation of the minimum cost of a coalition of state governments in meeting water requirements, posited against the minimum cost of an individual state in meeting those requirements without cooperative assistance. Provision is also made for physical, political and institutional constraints. Application to certain present-day Indian interstate water allocation disputes shows that this approach can provide negotiation solutions only in limited cases. In federal-state relationships it is useful only where there are no national competing claims on a water supply sought by a state. To mediate in these latter disputes, a national water resources council is proposed which would be coordinated by the national government. Indian states, fearing control of such a council by the national government, have strongly opposed such a scheme. (Harris-Wisconsin)
W80-03142

UNCERTAINTY AND ALLOCATION DECISIONS INVOLVING UNIQUE ENVIRONMENTAL RESOURCES,
North Carolina Univ. at Chapel Hill. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W80-03146

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART II LOW-FLOW FREQUENCY CHARACTERISTICS OF THE SUSQUEHANNA RIVER BETWEEN WAVERLY, NEW YORK AND SUNBURY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
D. L. Bingham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 392, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-52, June 1979. 31 p, 17 Fig, 6 Tab, 5 Ref.

Descriptors: *Model studies, *Low-flow frequency, *Flood routing, *Streamflow, *Simulation analysis, New York, Pennsylvania, Frequency curves, Analytical techniques, Evaluation, Flow rates, Gaging stations, *Ungaged sites, *Susquehanna River basin(PA), Susquehanna River Basin Commission.

Six flow-routing models were developed, calibrated, and verified for the Susquehanna River between Waverly, New York, and Sunbury, Pennsylvania. The models give the Susquehanna River Basin Commission tools to estimate effects of water-resource developments upstream from Waverly upon four gaged sites and two ungaged sites within the study reach. The models were used to simulate a 32-year record of daily flows at the two ungaged sites. Low-flow frequency curves for simulated flows at these sites were used to estimate 7-day low-flows at the 10-year recurrence interval of 540 and 770 cubic feet per second, respectively. The model errors, differences between model results and observed streamflow at gaged sites, are considered to be within reasonable limits and overall quality of simulated streamflow and low-flow frequency curves is considered good. (Woodard-USGS)
W80-03163

ESTIMATED DRAWDOWNS IN THE FLORIDAN AQUIFER DUE TO INCREASED WITHDRAWALS, DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. J. Franks, and G. G. Phelps.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119860, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-84, 1979. 22 p, 6 Fig, 3 Tab, 24 Ref.

Descriptors: *Drawdown, *Projections, *Aquifers, *Withdrawal, *Analytical techniques, Aquifer characteristics, Hydrogeology, Transmissivity, Storage coefficient, Permeability, Saline water intrusion, Groundwater, Aquifer management, Regression analysis, Simulation analysis, Florida, *Floridan aquifer, *Dade County(FL).

Hydrologic investigations of the Floridan aquifer in Duval County, Florida, have shown that an appropriate simplified model of the aquifer system consists of a series of sub aquifers separated by semipermeable beds. Data from more than 20 aquifer tests were reanalyzed by the Hantush modified method, which takes into account leakance from all confining units. Transmissivity values range from 20,000 to 240,000 square feet per day. Leakance was estimated to be 2.5x10 to the minus 6th power and 3.3x10 to the minus 5th power per day for the upper and lower confining units, respectively. Families of steady-state distance-drawdown curves were constructed for three representative transmissivity values based on hypothetical withdrawals from a point source ranging from 5 to 50 million gallons per day. Transient effects were not considered because the system reaches steady-state conditions within the time ranges considered. Drawdown at any point can be estimated by summing the effects of any hypothetical configuration of pumping centers. The accuracy of the parameters was checked by comparing calculated drawdowns in selected observation wells to measured water-level declines. (Woodard-USGS)
W80-03165

6B. Evaluation Process

MEASURING THE RISKS OF WASTE DISPOSAL BY DEEP-WELL INJECTION,
Marquette Univ., Milwaukee, WI.
C. H. Breeden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139629, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State College, Blacksburg, Bulletin 122, 1980. 42 p, 5 Fig, 3 Tab. 28 Ref. OWRT A-066-VA(2).

Descriptors: *Waste disposal, *Injection wells, *Economic feasibility, Evaluation, *Deep-well waste disposal, Environmental risk.

Much research has been conducted previously on the direct physical costs and the economic effects of changes in operating criteria and design parameters for deep-well waste disposal systems. However, many important considerations, such as the evaluation of risk in the design and operation of a disposal well, have received less attention. This study addresses these injection well failure data, which are important to both industrial and public policy decisionmakers who need to assess the genuine economic feasibility of this disposal method. In addition to identifying the direct costs of deep-well waste disposal, the study (1) illustrates ways in which a decisionmaker might quantify the risks associated with waste injection in an attempt to make these contingent costs explicit, and (2) presents computations for the indirect costs of uncertain risks by using an expected value technique and applying it to several hypothetical circumstances.
W80-03005

THE PROBLEM OF DROUGHT IN BOTSWANA,
University Coll. of Botswana, Gaborone. Dept. of Geography.
H. J. Cooke.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 7-20, 1979. 23 Ref.

Descriptors: *Droughts, *Botswana, *Thermal stress, *Arid climates, Crop response, Water shortage, Weather patterns, Africa, Comprehensive planning, Soil properties.

The drought-sensitive country of Botswana can be characterized by a lack of rainfall severe enough, of long enough duration, and of wide enough extent throughout the country to have a deleterious effect on plant growth, as well as on water supplies for stock use, domestic use, and urban-industrial-mining purposes. Given the poor, erratic, and unreliable nature of its rainfall, along with generally poor-quality soils, Botswana is threatened continuously by potential water shortage stress. Several aspects of this stress are reviewed here to define drought in terms appropriate to Botswana, including its historical patterns, water supply and demand, its relation to man and animal, government research and policy, education, legislation and implementation; and to examine some of its physical aspects and elucidate its causes. (Tickes-Arizona)
W80-03058

DROUGHT SUSCEPTIBILITY SURVEY AND THE CONCEPT OF MONITORING LANDSCAPE ECOLOGY,

International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
H. Th. Verstappen.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 75-81, 1979. 4 Fig.

Descriptors: *Droughts, *Monitoring, *Comprehensive planning, *Remote sensing, Seasonal, Mapping, Botswana, Surveys.

The evaluation and planning of drought relief in arid and semiarid lands require that complex and diversified factors of anthropogenic as well as climatic nature be continuously monitored. Various modes of remote acquisition of environmental data including the use of aerospace technology to inventory, classify, and evaluate the ecological situation in these drought-prone regions are reviewed here to indicate that careful selection of the most appropriate techniques for specific purposes, such as observation of seasonal variations, drought susceptibility classification, and quantification of the desertification process, is essential in obtaining optimum results. It is hoped that a drought susceptibility map of the whole of Botswana and other countries as well will ultimately become available as an operational tool in combatting the adverse effects of drought. (Tickes-Arizona)
W80-03065

DROUGHT IN THE SAHEL: A BROADER INTERPRETATION, WITH REGARD TO WEST AFRICA AND ETHIOPIA,
International African Inst., London (England).
H. I. Wetherell, J. Holt, and P. Richards.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 131-141, 1979. 4 Fig, 17 Ref.

Descriptors: *Droughts, *Africa, *Sahel, *Pasture management, *Rural sociology, Semiarid climates, Weather data, Economic impact, Social aspects, Monitoring, Rainfall, Planning.

An examination of the recent work on drought in Africa indicates (1) a tendency to underestimate the extent to which drought disaster-proneness relates to and derives from social and economic factors, and (2) a growing awareness of the importance of drought and rainfall unreliability in areas outside the low rainfall extremities of the semiarid zone. To gain a wider appreciation of drought in Africa, areas in Nigeria and Sierra Leone, where climates are quite different from the Sahel proper, and in Ethiopia, where superficial similarities with the Sahel may hide basic differences, are analyzed. At present, the true complexity of Africa's drought phenomenon, in terms of spatial and temporal rainfall fluctuations and their social and economic impact, is inadequately reflected in data from the continent's sparse network of rainfall stations. These authors suggest that much may be gained, nevertheless, from a policy of incorporating local observations and perceptions into drought and rainfall monitoring work. In the absence of high technology monitoring devices, there is every reason why farmers should maintain their traditional close observation to minimize the risks involved in recurrent droughts, and governments and planners would do well to recognize how much they have to learn directly from local farmers and herdsmen. (Tickes-Arizona)
W80-03068

EXPERIENCE OF DROUGHT IN THE SAHEL REGION,
Regional Centre for Training and Application of Agrometeorology and Operational Hydrology, Niamey (Niger).
D. Rijks.
In: Proceedings Symposium on Drought in Botswanna, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 142-146, 1979.

Descriptors: *Droughts, *Networks, *Regional analysis, *Environmental effects, Water supply, Information exchange, Vegetation effects, Sahel, Africa.

Rainfall and drought patterns, the causes of drought and the methods available for dealing with drought in the Sahel are discussed. Drought, described here as a situation in which lack of available water significantly impairs the routine human activities that occur in normal years, including arable farming, livestock husbandry, domestic water supply, health, navigation, and electricity generation, is largely caused in the Sahel by basic meteorological factors. Actions possible for dealing with drought in certain circumstances are multiple, varying according to the physical situation at any one time and place. These actions and their means of implementation are enumerated, with the emphasis largely on the necessity of defining a course of future action to alleviate the detrimental effects of drought. Fundamentally this means a qualitative assessment of the availability of water in the Sahel and the state of vegetation as a result of this water availability. The author's recommendations rest largely on the establishment of information networks between countries affected, including stations where observations on meteorology, hydrology, vegetation, crop growth, and livestock conditions can be made and disseminated daily on an area-wide scale, not only to governments but by radio, perhaps, to individual herdsmen and farmers. (Tickes-Arizona)
W80-03069

BIOLOGICAL BASIS FOR ASSESSING IMPACTS OF CHANNEL MODIFICATION: INVERTEBRATE PRODUCTION, DRIFT, AND FISH FEEDING IN A SOUTHEASTERN BLACKWATER RIVER,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
A. C. Benke, D. M. Gillespie, and F. K. Parrish.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139793, Price codes: A10 in paper copy, A01 in microfiche. Report No. ERC 06-79. 201 p, 33 Fig, 33 Tab, 211 Ref, 3 Append. OWRT B-105-GA(1).

Descriptors: *Georgia, *Invertebrates, *Secondary productivity, *Food chains, Population, Standing crops, Food abundance, Environmental effects, Biomass, Aquatic productivity, Aquatic insects, Fish food organisms, Channeling, Aquatic drift, Aquatic habitats, Satilla River.

Invertebrate production dynamics in the Satilla River in Georgia were studied to determine the effect of channelization or other river alterations on animal diversity, productivity, and general river ecology. The 362 km blackwater river has a drainage basin of 9143 sq km with good to excellent water quality. Invertebrates were studied in three major habitats: snags, submerged wooden substrates; the main channel, sandy benthic conditions; and the muddy benthic habitat of backwater areas. Sampling was conducted at two sites on the river, one near Waycross 290 km from the Atlantic Ocean and one at Atkinson 129 km from the ocean. Samples taken to determine the relative importance of the various invertebrate habitats included: (1) quantitative sampling to estimate invertebrate production; (2) invertebrate drift sampling with notation of habitat of origin for drift organisms; and (3) sampling of the feeding habits of major fish species to determine trophic pathways and the habitats of origin of the fish. Results show that the snag habitat had the greatest species diversity, standing stock biomass, and total production with weights of 57 to 72 g dry wt/sq m. Drift samples revealed that approximately 80% of the animals found in the drift originated from the snags. Drift densities were high compared to other rivers with roughly 3 invertebrates/c um. The major insectivorous fish species, redbreast, bluegills, and largemouth bass, are largely dependent upon snags as sources of food. Due to this importance to invertebrates, the removal of snag habitats and/or channelization of the river would cause a significant decline in animal diversity and productivity. (Seigler-IPA)
W80-03078

PROVIDING RURAL WATER: CONSTRAINTS AND IMPACTS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
D. Allee, H. Capener, J. Francis, and B. Brower.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska, on November 4-5, 1976. p 27-36.

Descriptors: *Social aspects, *Rural sociology, *Water supply development, *Social impact, *National Demonstration Water Project, Community development, Rural areas, Water supply, Sewerage, Water allocation(Policy), Domestic water, Potable water, Economics, Economic impact, Social adjustment, Local governments, Social needs, Social values, Social participation, Water users, Water utilization.

Social constraints and impacts of providing rural water, collected as part of the National Demonstration Water Project, are summarized. When constraints are removed from rural water development, impacts are produced. Many constraints exist on rural water development; however, most are site-specific. One important impact of water development projects is the production of local community leaders. Community development is stimulated in the long run by leaders who not only solve water problems but other community problems. Passing bond issues is used as an example of trust between community members and their leadership. For the national statistical assessment, a general model of household users and community situations is being developed. The model identifies key household variables for sufficient water quantity and quality. The model reflects not only persons on community water systems but also those located on individual water sources. Social-cultural factors and regional attitudes are considered. Household size, composition, and plumbing type are also included. Various water uses such as drinking, bathing, doing dishes and laundry, water for livestock and gardens, car washing, and lawn watering are also listed. Community assessment consists of identifying a physical problem (lack of water, pollution due to inadequate sewers) the community's awareness of it and whether they have resources available to cope with it. Resources include social resources such as organizational capability and physical resources such as money. (See also W78-11244) (Danovich-Wisconsin)
W80-03126

RURAL WATER: STATE PROGRAMS,
North Dakota Association of REC's, and RTC's, Mandan.
J. Ketterling.
In: Water Problems in the Rural Environment, Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 37-43.

Descriptors: *Water supply development, *Rural areas, *North Dakota, *South Dakota, *Minnesota, Water supply, Community development, Domestic water, Potable water, State governments, Social needs, Water users, Water utilization, Water quality, Water resources, Water resources development, Governmental interrelations, Costs.

This paper discusses North Dakota, South Dakota, and Minnesota programs on rural water systems development. In North Dakota, underground water quality is extremely poor and quantities are inadequate for basic domestic and livestock needs. North Dakota also faces large-scale coal development. Rural water systems development began in 1971; today four systems are operational, four are under construction, and two other cooperative associations have tentative funding approval from the Farmers Home Administration. Water resources management is under direction of a seven-member commission appointed by the governor; however, no clearly defined coordination exists between the departments of Health and Agriculture and the State Water Commission. Water systems operate under extreme financial pressures because of increasing material and labor costs and the need to bury water lines a minimum of seven feet to prevent winter freeze-up. Average household water bills amount to $25-35 for 6,000 gal/mo.

Experiences in South Dakota are similar with costly installation for rural water systems due to six feet minimum burial of water lines and the sparse population. More rural water systems are now being organized in both North and South Dakota. Minnesota problems include a lack of adequate well records, funds for tests drilling, and technical assistance. Rural electric cooperatives fully support efforts to obtain good quality domestic water for rural families and communities. (See also W78-11244) (Danovich-Wisconsin)
W80-03127

ASSURING ADEQUATE SUPPLY: QUANTITY AND QUALITY,
Nebraska State Dept. of Health, Lincoln. Div. of Environmental Engineering.
For primary bibliographic entry see Field 6D.
W80-03129

ALTERNATIVE WATER SUPPLY SYSTEMS IN RURAL AREAS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Austin.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 61-72. 2 Fig, 3 Tab, 4 Ref.

Descriptors: *Alternative planning, *Iowa, *Rural areas, *Water supply development, *Economics, Costs, Economic efficiency, Water supply, Water quality, Wells, Regional planning, Regional development, Regional analysis, Domestic water, Potable water, Economies of scale, Rates, Economic feasibility.

This paper discusses relative economies of three alternative rural water supply systems; individual wells, cluster wells and regional wells. No single system is judged best in all cases. Individual wells generally are the most economical solution, provided an adequate supply of good quality water can be obtained from shallow wells. If shallow groundwater resources are limited, cluster wells provide some economy of scale by spreading capital costs over a greater number of users. Regional rural water systems require much larger investments per user. Operational efficiency is higher for cluster wells and regional systems than individual systems. A rough comprison of relative costs of alternative systems was made in a hypothetical area in north central Iowa where farms are far apart, the aquifer is 200 feet deep, and water is very hard (613 mg CaCO3/l) and has high iron contents (3 mg/l). An individual well costs $26.22/mo; this does not include funds set aside for repair or equipment maintenance. A cluster well system costs $25.34/mo which is less than an individual well system. Costs for 8000 gal/mo from three rural water systems currently in Iowa range $26.05-$31.78. Central regional systems advanages include economies of scale, in well and treatment plant, centralized operation and management, and ability to use more sophisticated treatment processes. Regional system capital cost per user is high but monthly costs are not significantly higher than other alternatives. (See also W78-11244) (Danovich-Wisconsin)
W80-03130

THE ECONOMICS OF RURAL WATER SUPPLY,
West Virginia Univ., Morgantown. Regional Research Inst.
P. C. Mann.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska, on November 4-5, 1976. p 91-100. 6 Ref.

Descriptors: *Rural areas, *Water supply, *Economies of scale, Economics, Costs, Financing, Population, Size, Capital costs, Operating costs, Distribution, Maintenance costs, Production, Water treatment, Water supply development, Rates, Consumption, Water utilization, Investment, Social aspects.

Rural water problems are derived from low per-capita incomes coupled with higher costs per consumer connection. Financing problems in rural water supply are largely linked to size disadvantages. Rural systems serving populations less than 10,000 constitute 94% of all water systems but account for less than 20% of population served by all water systems. Most rural communities lack funds needed to absorb initial costs and some even have difficulty covering sustaining costs such as operation and maintenance. For rural water systems, smallness in size tends to preclude potential economies of scale in source of supply, transmission, and treatment. This results in higher operation and capital investment costs on both per user and per output unit basis than for larger urban systems. The market characteristic of low user density means higher initial costs per connection. Low density also means increased transmission costs per connection in periodic system maintenance. Rural water systems generally have users with lower incomes than consumers in urban systems. Less affluent customers consume less water per capita, thus precluding economies of scale in production and distribution. Different types of rate structures such as flat charge, uniform, declining block, and inverted block rates are discussed. Social pricing such as lifeline rates and utility stamps are also mentioned. (See also W78-11244) (Danovich-Wisconsin)
W80-03132

SOME ASPECTS OF MANAGEMENT-RURAL WATER SYSTEMS,
Utility Management Service, McComb, MS.
C. C. Hale.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 107-109.

Descriptors: *Water supply, *Management, *Rural area, *Potable water, Water quality, Public health, Costs, Safe Drinking Water Act, Regional planning, Planning, Standards, Water supply development, Taxes, Size, Economies of scale, Water treatment, Distribution, Personnel.

A critical weakness in delivering safe drinking water to rural areas is the lack of management. The purpose of community water systems is to provide adequate supply of safe potable water on a continuous basis and at the lowest cost to consumers. A serious deficiency exists in the lack of measurement standards for a water system's performance. Generally accepted criteria do not exist, although the Safe Drinking Water Act of 1974 will correct major abuses. Most states do not require licenses for water systems managers. Many system operating costs are subsidized by tax revenues. If tax subsidies are not used, management must run water systems on careful budgets. Another major handicap is that lack of overall planning, results in systems which cannot accommodate normal growth without extensive plant and distribution rebuilding. A problem unique to rural water systems is small size and problems of scale. Operating dispersed wells and treatment plants adds to cost and complexity. Early warning systems are needed for malfunctions in order to cope with crises. (See also W78-11244) (Danovich-Wisconsin)
W80-03134

MANAGEMENT OF WATER RESOURCES - A CO-OPERATIVE GAME-THEORETIC APPROACH TO INTER-STATE PROBLEMS,
For primary bibliographic entry see Field 6A.
W80-03142

THE USE OF DEVELOPMENT VALUE ESTIMATES FOR COASTAL WETLAND PERMIT DECISIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
L. Shabman, and M. K. Bertelson.
Land Economics, Vol 55, No 2, p 213-222, May 1979. 1 Tab, 20 Ref.

Descriptors: *Wetlands, *Market value, *Land development, *Methodolgy, *Estimating equations, Coastal marshes, Permits, Decision making, Costs, Benefits, Land use, Virginia, Virginia Beach(VA), Planning, Economic efficiency, Value, Regression analysis, Least-squares/method, Wetland filling.

Readily available courthouse records are the data source for an inexpensive procedure for estimating development values of wetlands; the procedure provides economic information about preservation and development uses of marshland for granting of wetland alteration permits. A hedonic price equation, which includes a variable to measure the level of waterfront amenity created from filled coastal marsh, predicts the value derived from filling wetlands for residential development. The net value for development, which is calculated by subtracting development cost, can be compared to the value of natural wetland. The equation was tested using standard regression techniques and data for land parcel sales in Virginia Beach, Virginia. Neighborhoods selected for study were socioeconomically homogeneous as possible to reduce the number of variables. The transfer price of a parcel, which represents the present value of the flow of annual returns, was used instead of prices to account for changes over time. Transfer prices are treated as a function of: (1) location factors; (2) historical factors; (3) improvements; and (4) site amenities. A hypothetical situation applied to the Virginia Beach example results in a net development benefit of $8,232/acre. This value must then be compared to the more elusive value of wetland preservation, which is formatted in terms of rising marginal value, irreversibility, and uncertainty, to determine if a permit should be granted. (Luedtke-Wisconsin)
W80-03144

UNCERTAINTY AND ALLOCATION DECISIONS INVOLVING UNIQUE ENVIRONMENTAL RESOURCES,
North Carolina Univ. at Chapel Hill. Dept. of Economics.
V. K. Smith.
Journal of Environmental Economics and Management, Vol 6, No 3, p 175-186, 1979. 31 Ref.

Descriptors: *Economics, *Investment, *Optimization, *Risks, *Resource allocation, Decision making, Environmental effects, Equations, Mathematical models, Cost-benefit analysis, Projects, Externalities, Planning, Conservation, Project planning, Resources, Regional development.

Modeling of uncertainty affects decision rules for irreversible investments, thus it is important to consider causes of uncertainty. This paper extends Fisher's work to account more directly for effects of the treatment of uncertainty along with irreversibilities in determining optimal investment decisions regarding environmental quality problems. Conventional benefit-cost analysis is oriented mainly toward appraising individual projects. Methodologies which treat each project in isolation lead to inconsistent decision-making where uncertainty is a significant constituent. These planning rules also ignore the potential for risk pooling across projects. These methodological inadequacies remain valid even with Fisher's modification of the Arrow-Lind theorem. Uncertainty arises because planners must estimate net benefits from a given mix of developed and preserved natural environments. Both scale and time of optimal investments may both be altered from those prescribed with conventional (Fisher-Krutilla-Cicchetti rule) frameworks when the potential for risk pooling is introduced. (Danovich-Wisconsin)
W80-03146

TECHNIQUES FOR REAL-TIME OPERATION OF FLOOD CONTROL RESERVOIRS IN THE MERRIMACK RIVER BASIN,
Hydrologic Engineering Center, Davis, CA.
B. S. Eichert, J. C. Peters, and A. F. Pabst.
Technical Paper No 45, November 1975. 43 p, 18 Fig, 5 Tab.

Descriptors: *Reservoir operation, *Systems analysis, *Flood control, *River regulation, Computer models, Streamflow forecasting, Simulation analysis, Flood damage, Forecasting, Analytical tech-

niques, Hydrologic systems, River basins, Discharge(Water), New England, Merrimack River Basin, Case studies, Real-time operation.

This paper contained a description of the techniques that are under development at The Hydrologic Engineering Center for providing decision criteria on a real-time basis for operating the five flood control reservoirs in the Merrimack River basin. Techniques under development include: (1) testing of alternative streamflow forecasting models; (2) application of computer program HEC-5C, Simulation of Flood Control and Conservation Systems, to develop decision-criteria for system operation on a real-time basis; and (3) use of computer terminals to enable analysis of alternative forecast and/or decision criteria in both batch mode and interactive applications. Each of these techniques were discussed following a brief description of characteristics of the basin, reservoir system, and automatic data collection network. (Humphreys-ISWS)
W80-03198

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE IMPACTS OF RURAL WATER SYSTEMS IN NORTH CAROLINA: AN EXPLORATORY STUDY.
North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
B. J. M. Knopf, J. E. McKinnon, and R. J. Burby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140072, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Rpt No 151, November 1979, 120 p, 7 Fig. OWRT A-103-NC(1), 14-34-0001-9035.

Descriptors: *Rural water systems, Investment decision-making, Impact assessment, Secondary impacts, Land use, Induced growth, Regionalization, Economic feasibility, Social impact, Environmental effects, *North Carolina, Rural communities, Water systems.

As a result of increasing rural community demand for urban-type service, concern exists that the installation of rural water systems will induce sprawl development with detrimental impacts. This report presents the results of a study on the formation, expansion and impacts of rural water systems in N.C. in an attempt to strengthen decision-making and project review procedures related to rural water systems. The findings indicate that local decisions regarding the formation and expansion of rural water systems have been based on present and anticipated needs and engineering and financial feasibility analyses. Decisions rarely included factors related to capital improvement budgeting and planning or long-term costs to communities of providing sewerage and other services required by the subsequently induced new development. The authors suggest there is a need for increased attention to local needs, goals and objectives related to location and timing of rural growth. Further, that county land classification plans would enhance the process as well as facilitate suggested local and regional review of proposed water investment plans.
W80-03003

ALTERNATIVE WATER SUPPLY SYSTEMS IN RURAL AREAS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W80-03130

THE ECONOMICS OF RURAL WATER SUPPLY,
West Virginia Univ., Morgantown. Regional Research Inst.
For primary bibliographic entry see Field 6B.
W80-03132

EXECUTIVE SUMMARY: WORKSHOPS ON SOCIO-ECONOMIC ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
R. J. Supalla.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska, on November 4-5, 1976. p 119-122.

Descriptors: *Water supply, *Rural areas, *Conferences, *Social aspects, *Economic impact, Planning, Water supply development, Zoning, Land use, Financing, Pricing, Management, Water quality, Standards, Water rights, Governments, Local governments, Public health, Economics, Costs, Rates.

Workshops on water problems in rural areas addressed socio-economic issues classified in nine categories: (1) water system development and planning, (2) zoning and land use impacts, (3) water system financing, (4) water pricing, (5) role of water system managers, (6) water quality standards, (7) impact of section 208 planning, (8) the rural water survey, and (9) water rights. Participants questioned the proper role of the Farmers Home Administration and felt the agency should assume some responsibility for successful administration of water systems they finance. Two widely held views are that local level administrative control is important and that increasingly careful water systems planning is needed to meet public health standards. Another major concern is coping with induced residential developments that occur along water lines. Most participants agreed that water systems should be financed through private enterprise with government subsidies used only as a backup. Also government agencies should consider social as well as economic benefits in deciding which water system to finance. An expanded federal grants program is also needed. Lifeline rate structures should be included in system pricing structures while declining rates should be abolished. 208 water quality planning will have significant impacts on both surface and ground-water sources because it addresses nitrate groundwater accumulations as well as sedimentation and erosion problems. (See also W78-11244) (Danovich-Wisconsin)
W80-03136

COMMENT ON 'THE EFFICIENCY AND EQUITY OF COST ALLOCATION METHODS FOR MULTIPURPOSE WATER PROJECTS' BY JAMES C. LOUGHLIN,
Environmental Protection Agency, Cincinnati, OH.
L. A. Rossman.
Water Resources Research, Vol 14, No 6, p 1195-1196, December 1978. 1 Tab, 2 Ref.

Descriptors: *Multiple-purpose projects, *Cost allocation, *Equity, *Efficiencies, Optimum development plans, Project planning, Economics, Costs, Separable cost allocation, Cost analysis, Monetary benefits, Model studies, Evaluation.

This comment takes exception to Loughlin's (1977) (See W78-02186) examination of three schemes for allocating costs of multipurpose projects to individual purposes with respect to a set of equity and efficiency criteria. Loughlin concluded that only the separable costs-remaining benefits (SCRB) method will satisfy the equity criterion. Two objections are raised: (1) Certain of the efficiency criteria should not be used for evaluating cost allocation methods; the criteria in question are actually project evaluation criteria and should be applied to the project before any cost allocation is made. (2) Loughlin's adjusted SCRB method actually gives less-equitable results than the original SCRB formula for projects where the justifiable costs with a purpose deleted are given by the alternative cost of providing all other purposes. A revised set of cost allocation criteria separate from the economic evaluation criteria and thus in keeping with the equity principles used by Loughlin would be: (1) The sum of total costs allocated to each purpose should equal total project cost. (2) The total costs allocated to each purpose should not exceed the cost of a single purpose alternative providing equivalent benefits. (3) Savings allocated to each purpose should be in the same proportion as savings realized by including each purpose in the project. The remedy to the problem of the SCRB formula not satisfying the equity criterion is simply to redefine the separable cost of a purpose as the total project cost minus the justifiable cost with this purpose deleted. (Harris-Wisconsin)
W80-03137

EFFICIENCY IN THE USE OF WATER FOR IRRIGATION: THE ROLE OF PRICES AND REGULATIONS,
United Nations Centre for Natural Resources, Energy and Transport, NY.
For primary bibliographic entry see Field 3F.
W80-03140

FINANCING YOUR POLLUTION CONTROL NEEDS,
B. A. Rose.
Industrial Finishing, Vol 54, No 12, p 12-15, December 1978.

Descriptors: *Water pollution, Control, *Equipment, *Electroplating industry, *Small businesses, *Financing, *Bond issues, *Loans, *Government finance, Small Business Administration, Environmental Protection Agency, California, Illinois, Economics, Investment, Cost repayment, Credit, Installation costs, Interest rates, Government supports, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Industrial production, Industrial wastes, Industrial plants, Pollution abatement.

Tax-exempt pollution control revenue bonds and low-interest loans are two low-cost alternatives for financing the addition of pollution control equipment by electro-platers and other small businesses. For firms needing $100,000 or more, the Small Business Administration (SBA) can guarantee payments on equipment loans or leases with funding through tax-exempt revenue bonds for existing small businesses of groups of businesses. By 1977, pilot programs were operative in California and Illinois, with state/local authorities issuing such bonds backed by SBA. Funds can be used for equipment and construction, bond issuance expenses, application feeds, reserve funding and refinancing of existing debts for equipment. However, procedures take more time than with a conventional loan and firms must not exceed certain size criteria, such as net worth, number of employees, income and other factors. For firms needing smaller loans ($5,000-$50,000), US Environmental Protection Agency (EPA) may make loans for equipment to meet water pollution control requirements. These loans are made to concerns likely to suffer economic injury because of regulatory requirements. Various federal criteria must be satisfied for eligibility, and no business can obtain an EPA loan if reasonable conventional financing is available. In addition, firms must meet small-size criteria as for the SBA tax-exempt revenue bonds financing. Federal loans and loan guarantees for industiral pollution control equipment are also available from the Economic Development Administration and the Farmers Home Adminstration. (Harris-Wisconsin)
W80-03145

MARKET METHODS OF MULTIPLE USE RECONCILIATION,
Victoria Univ. (British Columbia). Dept. of Economics.
G. R. Walter.
Journal of Environmental Management, Vol 7, No 3, p 291-296, November 1978, 2 Tab, 4 Ref.

Descriptors: *Pricing, *Market value, *Willingness-to-pay, *Land resources, *Recreation, *Multiple-purpose projects, Economics, Value, Elasticity of demand, Elasticity of supply, Recreation demand, Natural resources, Forest management, National parks, Camp sites, Boat-launching ramps, Hunting, Fishing, Recreation facilities, Leases.

Theoretical and practical questions of equity and efficiency are discussed in regard to evaluation and

pricing of certain multiple-use services provided by land resources (Such as wood production, wildlife management, watershed benefits, outdoor recreation, range products, and aesthetic considerations). It is suggested that most of these services are in fact marketable, and that many services could be supported by a system of user charges, permit fees or leasing. If there are many uses of a land area under public domain, a number of agencies may have obtained a proprietary interest by legislative mandate; unless there are some explicit measures of the welfare to be gained by the clientele served, so that their increase in welfare may be considered against the cost to the public purse, the result is likely to be an array of services determined solely by relative political strength. A number of basic revenue structures are available to achieve rational economic management of multiple-use services: (1) budgetary allocations out of general revenue (taxes); (2) monies obtained from bids or leases for an identifiable special-interest area such as a historical site, waterfall, small lake, etc; (3) permits for access to forest or other land-based zones; (4) user's fees for use of a marketable services such as camping, picnics, boat launching, etc.; and (5) road tolls for access to the overall multiple-use site or facility. (Harris-Wisconsin)
W80-03147

MONOPOLY-POWER AS A MEANS FOR POLLUTION-CONTROL.
A. Endres.
The Journal of Industrial Economics, Vol 27, No 2, p 185-187, December 1978, 5 Ref.

Descriptors: *Economic justification, *Monopoly, *Competition, *Regulation, *Pollution abatement, Economics, Externalities, Water pollution control, Polluter-pays principle, Competitive prices, Model studies, Abatement, Costs, Benefits,.

Many resource economists traditionally hold that allocative distortions caused by monopoly power in the market place and external diseconomies compensate each other; this line of reasoning assumes that a polluting monopolist, producing too much as a polluter and too little as a monopolist, will develop a Pareto-optimal solution for control of pollution. However, this short paper illustrate in theory that monopoly power as a means for pollution control is no more efficient in a perfectly competitive economy than taxes on output instead of pollution to accomplish the same task. It is noted that a polluting monopolist assumed to produce optimal output will realize the optimal level of pollution only if output reduction is the sole means to reduce the externality. When other efficient measures are possible, monopoly power can never correct the allocative failure of an external diseconomy, even in theory, because the monopolist will not use the efficient input mix. These points are demonstrated in a mathematical model of pollution outputs by a perfectly competitive firm and an unregulated monopolist. If firms of a perfectly competitive polluting industry are forced by a Pigovian tax to bear the marginal cost of the damage they cause, the Pareto-optical output and pollution level will be produced. However, with no Pigovian taxes and no other regulation, the monopolist has no incentive to employ any resources in additional abatement (such as installation of filters) which would compensate for the lack of tax reimbursement. (Harris-Wisconsin)
W80-03148

6D. Water Demand

ASSURING ADEQUATE SUPPLY: QUANTITY AND QUALITY,
Nebraska State Dept. of Health, Lincoln. Div. of Environmental Engineering.
C. L. Summers.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 55-60.

Descriptors: *Rural areas, *Water supply, *Water quality, *Potable water, *Water demand, Costs, Water supply development, Domestic water, Regulations, Water users, Water utilization, Water requirements, Consumptive use, Public health, Economics, Reliability, Safe Drinking Water Act, Groundwater, Cost-benefit analysis, Benefits, Wells.

Parameters for determining adequate water supply include water user needs, safety and health protection, reliability, and economic capability. User requirements vary 30-800 gal/d for per capita use in individual households. If groundwater resources are totally reserved for domestic use, sufficient quantities are available. Large withdrawals for industry, irrigation, and heavily populated areas reduce water resource accessibility for individuals. Natural groundwater filtering effectively removes bacteria and other microorganisms. Water quality often diminishes with well construction and installation methods. Nitrate nitrogen concentrations above 10 mg/l are associated with bacterial contamination. Assuring drinking water quality for individual water supply systems can be complex and costly, especially to comply with primary contaminant levels. The Safe Water Drinking Act of 1974 has significant social and economic implications. Mandating safe drinking water from private wells, beyond biological and nitrate parameters, requires large expenditures for enforcement while benefits are difficult to measure. In communities smaller than 100 population with a small water system, annual capital and operating costs for safe drinking water are expected to increase household monthly water bills $3-23. As governmental control extends to small community and individual household systems, the benefit-cost approach or cost-effectiveness must be defined and presented, in an acceptable manner to consumers. (See also W78-11244) (Danovich-Wisconsin)
W80-03129

THE ECONOMICS OF RURAL WATER SUPPLY,
West Virginia Univ., Morgantown. Regional Research Inst.
For primary bibliographic entry see Field 6B.
W80-03132

EXECUTIVE SUMMARY: WORKSHOPS ON TECHNOLOGICAL ASPECTS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering,
W. J. Jewell.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply, and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 111-117. 5 Ref.

Descriptors: *Conferences, *Water supply, *Rural area, *Research priorities, Governments, Political aspects, Water demand, Nitrates, Water pollution, Standards, Water rights, Nebraska, Social aspects, Water pollution control, Technology, Economic impact, Future planning(Projected), Groundwater, Safe Water Drinking Act, Sewage sludge, Sewage disposal, Education.

This paper reviews progress in rural water systems, summarizes workshop activities and suggests topics for additional research. Rural water problems are now given greater attention by private groups as well as governmental agencies. Political entities of rural water districts and natural resource districts significantly increase capabilities to deal with rural environmental quality problems. Since Nebraska and its neighboring states were experiencing a serious drought, this was discussed almost exclusively in workshops. Conference workshop conclusions are divided into water supplies and needs, and wastewater control. A common problem is anticipating growth and future water supply demands. The primary water quality concern is contamination with nitrates. Drinking water standards need to be enforceable and easily understood. A better working definition of 'right to water' is need to guide rural water program implementation. Preventing nitrate entry to groundwater and septic tank pollution control were also discussed. One important rural water research need is to define more clearly relationships between technical-social-economic issues and to relate these to resource development and utilization. Widespread education programs are needed to support the Safe Water Drinking Act. Several key technological alternatives for pollution control are needed, most importantly for nitrate removal from drinking water. Little is also known about effects of private usage of sewage sludge for ultimate disposal. (See also W78-11244) (Danovich-Wisconsin)
W80-03135

6E. Water Law and Institutions

LEGAL RIGHTS TO SEWAGE EFFLUENT,
D. Sliz, and S. Powell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139603, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Tucson. Project Completion Report, October 15, 1979. 76 p, 196 Ref. OWRT A-090-ARIZ(1).

Descriptors: *Water reuse, *Reclaimed water, *Arizona, *Sewage effluents, Sewage districts, Water users, Water rights, Legal aspects, Water shortage, Groundwater recharge, Aquifers, Legislation, Groundwater mining, Sewage, Water management(Applied), Potential water supply.

The legal aspects of waste water recapture or reuse are examined for the Tucson, Arizona, area, however, the legal problems examined are not limited exclusively to this area. The sole source of water supply for Tucson is pumped groundwater from the alluvial basin of an intermittent stream, the Santa Cruz. Due to the limited water resources of the area problems over the legal rights of the city and county to control sewage effluent from the city have developed. In the past treated effluent was discharged into the Santa Cruz stream bed for recharge of the aquifer. The city now plans to recapture and reuse or exchange the effluent. However, Pima County has contracted with an irrigation district to sell treated effluent from the Ina Road plant which is located in the county but treats city waste water. The city of Tucson has filed a complaint to prevent the county control of effluent originating in the municipal system. There are also other actual and potential conflicts over disposition and use of effluent. Case law and selected statutes which currently govern recapture are analyzed and the right of the city to use and to reuse water pumped from the Santa Cruz basin is examined. It is concluded that sewage effluent rights need to be defined or clarified by statute. Recommendations of appropriate legislation are provided. (Seigler-IPA)
W80-03009

CONTROLLING LAND USE FOR WATER MANAGEMENT AND URBAN GROWTH MANAGEMENT: A POLICY ANALYSIS,
California Univ., Davis.
S. I. Schwartz, R. A. Johnston, J. R. Blackmarr, and D. E. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139538, Price codes: A05 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis, Contribution 180, December 1979, 80 p, (California Water Resources Center Project UCAL-WRC-W-487).

Descriptors: *Land use, *Water resources, *Control, *Urbanization, Planning, *Political constraints, Constraints, Political aspects, Taxes, Zoning, Economics, Water resources development.

This study reviews 18 land use control measures for application in water resources and urban growth management. The measures are carefully described and the evaluation literature is reviewed. An evaluation process and framework are then proposed. Existing evaluation methods were found deficient with respect to the requirements of this particular situation therefore a new method is proposed that is based in part on Etzioni's mixed scanning approach and utilizes a two stage evalua-

tion. The first stage consists of an initial scan which examines potential effectiveness and feasibility and identifies the most promising alternatives. The second stage involves a more detailed analysis which focuses on other impacts as well as feasibility and effectiveness criteria. The emphasis on constraints to implementation, especially political, is a feature that other evaluation methods neglect. The assessment of political feasibility is based on an analysis of the probable response of several interest groups to the perceived outcomes of each of the land use control measures. (Snyder-Cal)
W80-03077

AN ASSESSMENT OF THE ON-SITE WASTE WATER MANAGEMENT PROGRAM IN THE STATE OF MAINE,
Maine Univ. at Orono.
J. D. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139579, Price codes: A08 in paper copy, A01 in microfiche. MS thesis May 1979. 162 p, 3 Fig, 25 Tab, 55 Ref, 5 Append, OWRT A-046-ME(1).

Descriptors: *Maine, *Waste water treatment, *Land use, *Regulation, Legal aspects, Plumbing, Inspections, Surveys, Administration, Management, Water policy, Municipal wastes, Waste disposal, Water pollution.

On-site waste water management proggram applications of the Maine Plumbing Code were studied to clarify the relationship between plumbing regulations and land use activity and to determine the perspective of the local plumbing inspector. State and local approaches to on-site waste water management programs administration and regulation were also studied. Results of a telephone survey of local plumbing inspectors were used to determine the role of the local inspector in Plumbing Code implementation. The Plumbing Code is widely accepted and meets local community needs 90% of the time. However, many communities are relying too heavily on the Code and are using it as a land use regulatory device. Maine's on-site waste water management program could be improved by providing additional local inspector training in the areas of land use and regulatory techniques along with more technical training in waste water disposal. Also, the reimbursement policies for local inspectors needs to be upgraded due to the technical aspects of the position. Other improvements are needed in the areas of funding, legal assistance, and municipal support for the inspectors. The Plumbing Code should be more formally linked to the Building Code and should involve contractors to insure the proper installation of disposal systems. Maine continues to have an on-site rather than a centralized approach to waste water treatment. (Seigler-IPA)
W80-03083

THE POLITICS OF IRRIGATION: AN EMPIRICAL TEST OF DEMOCRACY IN GREAT PLAINS RESOURCE DISTRICTS,
Kansas Univ., Lawrence. Dept. of Political Science.
C. G. Heatwole.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139587, Price codes: A18 in paper copy, A01 in microfiche. Doctoral dissertation, May 1979, Volumes I and II, 406 p, 36 Fig, 68 Tab, 208 Ref, 2 Append, OWRT B-046-KAN(1).

Descriptors: *Political aspects, *Local governments, *Irrigation districts, *Groundwater mining, Texas, New Mexico, Kansas, Nebraska, Colorado, Great Plains, Governments, Water policy, Agriculture, Decisionmaking, Administration, Democracy, Grass roots.

Resource districts in the Great Plains states of Texas, New Mexico, Kansas, Nebraska, and Colorado are examined as examples of a decentralized form of government and how this decentralization effects democracy. Presumably these decentralized units of government provide the conditions, participation, responsiveness, and accountability, needed for realizing the democratic ideal. Resource districts were formed in many Great Plains states to deal with the serious natural resource problem of groundwater mining. The irrigation based economy of the Great Plains has forced farmers to maximize production regardless of prices or ecological concerns. Using these resource districts the claims for and against grass roots structures are analyzed. These special districts are described in detail including their history, types, numbers, functions, and structure. Highly autonomous and functionally general districts are emphasized. Optimistic and pessimistic views are given for the districts in terms of responsiveness, accountability, and participation. Mixed results fail to wholly substantiate either viewpoint. The 'democratic theory' is not borne out by the study results. (Seigler-IPA)
W80-03086

TOWARD A NATIONAL PROGRAM FOR RURAL WATER-SEWER DEVELOPMENT: THE BASIC ISSUES,
National Demonstration Water Project, Washington, DC.
S. Zimmerman.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 15-26.

Descriptors: *Governments, *Sewerage, *Water supply development, *Rural areas, *State governments, Federal governments, Local governments, Regulation, Governmental interrelations, Water supply, Water conveyance, Community development, Domestic water, Potable water, Water quality, Government finance, Costs, Financing.

State governments must take a stronger stance than they have in the past in regard to rural water development. Although many agencies deal with only one area (health standards, rates, financing, or planning), interrelatedness must be recognized to correct past problems. As many as 30 million people do not have adequate domestic water or wastewater disposal facilities. Need is greater in the southeastern U.S. although it exists in virtually all parts of the country. Rural residents need adequate water-sewer facilities at rates they can afford. For water-sewer development to occur, local attitudinal factors must be considered and significant community groups identified. The federal government finances and regulates rural water and sewer development through the U.S. Department of Agriculture's Farmers Home Administration and the U.S. Environmental Protection Agency. Federal agencies presently provide the bulk of outside financing local communities receive. Financial assistance programs for water systems are also sponsored by 16 states. Community water system supply design, operation and output are usually monitored by state health departments. State coordinated programs for rural water-sewer development should include: local level development with state assistance; financing from all government levels with federal funds channeled through state governments; and state regulations operating under federal guidelines. (See also W78-11244) (Danovich-Wisconsin)
W80-03125

RURAL WATER: STATE-FEDERAL RELATIONSHIPS,
North Dakota State Senator, Solen.
F. Barth.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal, Proceedings of a Conference Held at Lincoln, Nebraska on November 4-5, 1976. p 45-51.

Descriptors: *Federal government, *North Dakota, *Water supply development, *Rural areas, *Governmental interrelations, *Legislation, State governments, Water supply, Domestic water, Potable water, Costs, Water quality, Water resources development, Government finance, Political aspects, Inter-agency cooperation, Institutional constraints.

This paper discusses bills presently before the North Dakota legislature regarding rural water system projects and problems in coordinating state programs with federal agencies. Two draft bills approved by the Committee on Agriculture were introduced to the 1977 legislative assembly. The community water facilities loan act provides $10 million to supplement federal money for construction or improvement of community water facilities. The second bill relates to community water facility grants. Grants may not exceed $250,000 or 10% of total project costs; $5 million is to be appropriated. These two bills enhance prospects for better coordination between state programs and federal agencies. The federal Farmers Home Administration program is one of the best which meets rural citizen's needs; however certain agricultural states such as North Dakota receive insufficient grants. Demonstrating economic feasibility for each system in rural areas is difficult. North Dakota has close liasion capacity with the Bureau of Reclamation which provides financial and engineering assistance for community and rural water systems. The Apple Creek Diversion takes water from the Missouri River and supplies three counties with domestic and irrigation water. Better coordination is presently needed with federal agencies such as Housing and Urban Development, Environmental Protection Agency, and Economic Development Assistance Program. (See also W78-11244) (Danovich-Wisconsin)
W80-03128

LEGAL PROBLEMS FACING RURAL DOMESTIC WATER USERS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
J. D. Aiken.
In: Water Problems in the Rural Environment; Alternative Solutions for Water Supply and Wastewater Disposal. Proceedings of a Conference Held at Lincoln Nebraska on November 4-5, 1976. p 101-106.

Descriptors: *Rural areas, *Water law, *Water rights, *Nebraska, Preferences(Water rights), Water supply, Wells, Nitrates, Water pollution sources, Fertilizers, Irrigation, Domestic water, Regulation, Priorities, Prior appropriation, Agriculture, Municipal water, Irrigation water, Industrial water, Judicial decisions.

This paper focuses on Nebraska Law and three rural water user issues: (1) water for municipalities and industry, (2) rural domestic water rights, and (3) nitrate pollution of groundwater supplies. Need for more governmental water regulation is suggested. In western states which follow appropriation rights, disputes among surface water users are resolved by the priority system. An exception to priority is the preference system which settles disputes among different war user classes. Typically, priority is given to domestic, then agriculture, and finally to industrial users. A problem frequently encountered is that municipal use is not recognized or if a municipality gives water to an industry, it's status as a domestic user is threatened. Another problem with the appropriation doctrine is that instream water uses, such as stockwatering, are not recognized. Conflicts with ranchers and irrigators have arisen and Nebraskan courts affirmed stockwatering as a domestic water use over irrigation. Conflicts have also arisen in Nebraska over loss of artesian pressure. In court cases, irrigators who pumped large water amounts and lowered the water table were liable for the loss of pressure to domestic well users. Nitrate groundwater pollution is increasing due to increased irrigation development. Excessive nitrates cause infant cyanosis and adversely affect plant and animal growth. Control strategies include restricting amounts of fertilizer used by farmers or amounts of water used in irrigation. (See also W78-11244) (Danovich-Wisconsin)
W80-03133

EXECUTIVE SUMMARY: WORKSHOPS ON TECHNOLOGICAL ASPECTS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering,
For primary bibliographic entry see Field 6D.

W80-03135

EXECUTIVE SUMMARY: WORKSHOPS ON SOCIO-ECONOMIC ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W80-03136

THE ECONOMICS OF THE EASTERN BLOCK OCEAN POLICY,
Washington Univ., Seattle. Inst. for Marine Studies.
V. Kaczynski.
American Economic Review, Vol 69, No 2, p 261-265, 1979. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Marine fisheries, *Economics, *Fish harvest, *Socialist countries, Oceans, 200-mile economic zone, Costs, Economic efficiency, Commercial fishing, Fishing fleets, Poland, East Germany, Soviet Union, Bulgaria, Rumania, Fuel.

The development of marine fisheries of the Eastern bloc countries is analyzed. Recent trends in use of ocean resources by socialist countries show that: (1) During the first half of the 1970s, they rapidly increased their share of the total world harvest of marine organisms. (2) The rate of growth of the catch volume was many times higher than that registered during the same period by world fisheries. (3) Beginning in 1976 socialist fishing nations showed a sharp slowdown in the rate of increase of their catch. A high degree of technological flexibility and adaptability, utilization of underutilized commercial species, well-developed maritime industries, particularly ship-building, and development of large factory trawlers are primarily responsible for this expansion. However, the magnitude of the Eastern ocean-going fleet reflects a massive investment and commitment to the exploitation of ocean fisheries. On the eve of widespread implementation of the 200-mile economic zone, 50-70% of their marine resources came from fishing grounds located 2000 to 9000 miles from their home ports with the most important of these under the jurisdiction of developed Western nations. Fuel consumption has been the single most important cost item in fleet operation presently constituting over 20% of total harvesting outlays. At the same time, legal limitations and depletion of the traditionally harvested species have reduced fishing opportunities. The current state of Eastern fisheries in which decreasing growth rates in catch are accompanied by disproportional increases in costs of ocean fisheries, has become a heavy economic burden for socialist governments. (Luedtke-Wisconsin)
W80-03138

EFFICIENCY IN THE USE OF WATER FOR IRRIGATION: THE ROLE OF PRICES AND REGULATIONS,
United Nations Centre for Natural Resources, Energy and Transport, NY.
For primary bibliographic entry see Field 3F.
W80-03140

200-MILE ECONOMIC ZONES -- FISHING LIMITS AND THE E.E.C.,
Carlton Univ., Ottawa (Ontario).
J. I. Prattis.
Maritime Policy and Management, Vol 5, No 4, p 327-331, 1978.

Descriptors: *200-mile economic zones, *International waters, *Jurisdiction, *Economic impact, *Fisheries, *Law of the Sea, Economic justification, E.E.C, Governments, International commissions, International law, Regulation, Atlantic Ocean, Permits, Political aspects, Foreign waters, Commercial fishing, Legal aspects, Oceans.

International effects of 200-mile offshore fishing and economic exploitation zones by coastal nations are discussed. Factors underlying the unilateral declaration of these 200-mile zones by many nations in January 1977 (following Iceland's historic examples in 1975) include: (1) general ineffectiveness of various international commissions concerned with conservation of fish stocks; (2) failure of various UN conferences on the Law of the Sea to arrive at any kind of consensus on international fishing limits; (3) rapid depletion of fish stocks on which certain countries depend for a major share of their gross national product. Problems created by this new policy have forced the E.E.C. to formulate an external fisheries policy and an internal fisheries system. The external fisheries policy is primarily concerned with phasing out of third-country fishing in E.E.C. waters, controlling access to the E.E.C. 200-mile zone by licenses, and securing reciprocal agreements to fish in third-country economic zones. The internal fisheries policy is concerned with harmonization of the E.E.C. fishing industry and this area of policy has caused considerable conflict between member states of the Common Market. Problems of the new policy include: (1) There is a danger that harmonization and regularization of the entire E.E.C. community fishing industry may be to the detriment of particular coastal areas entirely dependent on fishing. (2) Conflict in policy preferences with E.E.C. prevents negotiation of multilateral fishing agreements and create an air of uncertainty, a constraint on planning and investment in the industry. (Harris-Wisconsin)
W80-03141

6F. Nonstructural Alternatives

ALTERNATIVE WATER SUPPLY SYSTEMS IN RURAL AREAS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W80-03130

6G. Ecologic Impact Of Water Development

THE IMPACTS OF RURAL WATER SYSTEMS IN NORTH CAROLINA: AN EXPLORATORY STUDY.
North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
For primary bibliographic entry see Field 6C.
W80-03003

DROUGHT AND MIGRATION: THE LAKE MALAWI LITTORAL AS A REGION OF REFUGE,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of African History.
J. B. Webster.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 148-157, 1979. 2 Fig, 20 Ref.

Descriptors: *Droughts, *Migration patterns, *Populations, Africa, Climatology, Distribution patterns, Spatial distribution.

The history of migrations into the Lake Malawi littoral is surveyed and coordinated where possible with known or suspected droughts in Central Africa. Nile levels, tree rings, documentation, and oral history moving chronologically backward beginning in the late 18th century and ending about 1285, are used in support of the postulation that the Lake Malawi littoral was seldom subjected to drought severe enough to force people to emigrate therefrom, but that Central Africa has witnessed droughts of such lengths and intensity that numerous peoples have been compelled to migrate into the area for survival. Although it is not suggested that drought was the only causal factor in the displacement of people, this paper clearly demonstrates the cause and effect relationship between climate and migration over 500 years of African history. (Tickes-Arizona)
W80-03070

UTILIZATION OF MUNICIPAL SEWAGE EFFLUENT AND SLUDGE ON FOREST AND DISTURBED LAND.
Proceedings of Symposium held in Philadelphia, PA, March 21-23, 1977. Edited by Sopper, W. E. and Kerr, S. N., 1979. 547 p. Pennsylvania State University Press, University Park. OWRT A-999-PA(6).

Descriptors: *Sewage effluents, *Irrigation effects, *Vegetation establishment, *Wildlife habitats, Forest management, Litter, Revegetation, Coal mine wastes, Vegetation effects, Ecology, Food chains, Chemical analysis, Soil physical properties, Infiltration, Microbiology, Public health, *Land application, *Wastewater disposal.

Text of forty-four papers presented at the symposium in Philadelphia is given. The papers review current knowledge related to the economic and environmental feasibility of applying treated municipal sewage effluent and sludge to promote forest land production and to rehabilitate disturbed surface mining areas. The current surge of interest in land application of treated waste water and sludge is stimulated by the energy crisis, increasing scarcity of mineral resources, the rising costs of commercial fertilizer, and new pollution and reclamation regulations. Seven topic areas covered under waste water and sludge application are: water quality and renovation, microbiological aspects, vegetation responses, forest soils, other ecosystem responses, public health, and system design and economics. Five areas covered under disturbed land revegetation are: sludge application methods, water quality and vegetation responses, microbiology and public health, domestic animals and wildlife, and guidelines and regulations. (See W80-03090 thru W80-03093) (Seigler-IPA)
W80-03089

EFFECT OF SPRAY IRRIGATION OF TREATED MUNICIPAL SEWAGE EFFLUENT ON THE ACCUMULATION AND DECOMPOSITION OF THE FOREST FLOOR,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
J. L. Richenderfer, and W. E. Sopper.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 163-177, 1979. 12 Tab, 19 Ref. OWRT-C-5169(4205)(3).

Descriptors: *Forest management, *Humus, *Irrigation effects, *Sewage effluents, Forestry, Erosion, Pine trees, Conifers, Hardwood, Deciduous trees, Decomposing organic matter, Degradation(Decomposition), Sludge disposal, Nitrogen, Litter, Leaves, *Land application, *Wastewater disposal, *Spray irrigation.

Treated municipal sewage effluent from a Pennsylvania State University treatment plant was used to study the effect of effluent spray irrigation on forest floor accumulation and decomposition in two forested areas, a mixed-hardwood stand and a red pine plantation. Irrigated and control plots of 0.20 ha were located in each forest area and waste water was applied weekly from 1963 to 1975. Application amounts varied from 2.5 cm/week to 3.8 cm/week applied over single four hour periods. In each plot, both irrigated and control, the following were measured: (1) depths and amounts of forest floors, (2) amounts of annual litter fall, (3) forest floor decomposition rates, and (4) environment and chemical factors affecting decomposition rates such as moisture, temperature, and carbon/nitrogen litter ratios. Results show that irrigation of effluent significantly reduced depth and amount of forest floor in both forests, however, there was no significant effect on annual litter fall amounts. The observed forest floor reductions were caused by increased decomposition rates resulting from increased moisture content, temperature, and higher total nitrogen levels caused by the effluent irrigation. The red pine irrigated plot had a 66% reduction in depth while the hardwood plot had a larger loss at 77%. This loss of forest floor cover could ultimately affect the physical and hydrologic properties of the soil due to increased exposure to raindrop impact which in turn would affect infiltration capacity resulting in increased overland flow and erosion. (See also W80-03089) (Seigler-IPA)
W80-03090

EFFECT OF MUNICIPAL WASTEWATER IRRIGATION ON THE PHYSICAL PROPERTIES OF THE SOIL,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper, and J. L. Richenderfer.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 179-195, 1979. 20 Tab, 1 Ref. OWRT-C-5169(4205)(4).

Descriptors: *Irrigation effects, *Sewage effluents, *Soil physical properties, *Porosity, *Infiltration, Soil stability, Capillary action, Drainage effects, Percolation, Permeability, Soil classification, Soil water movement, Irrigation practices, Irrigation water, *Land application, *Spray irrigation.

Two soil types at sites near Pennsylvania State University were used to study the effect of waste water irrigation on the infiltration and percolation capacities of the soils. One soil type, Hublersburg silt loam has a silt loam topsoil with silty clay or clay subsoil giving moderate to moderately rapid permeability. The other soil type is in the Morrison and Gatesburg series with moderately rapid to very rapid permeability. Study areas were used representing six vegetative cover types, a reed canarygrass area, a corn field, an old field area, a mixed hardwood forest area, and a red pine plantation. In a each area there were 0.20 ha control and treatment plots getting weekly applications of sewage effluent. Measurements were taken in the treated and control plots for infiltration capacities using a double-ring infiltrometer and an Alderfer-Robinson-type infiltrometer; percolation capacity; total capillary and noncapillary porosities; bulk density; water stability index of soil aggregates; and root mass content. Results show that spray irrigation of effluent significantly reduced infiltration capacities in the Hublersburg silt loam in both forested areas and in the reed canarygrass area while increasing infiltration in the corn area. Percolation capacities were not significantly affected in the agricultural or forested soils, however, percolation capacities were reduced on all effluent irrigated areas in the agronomy and old field plots. Total or capillary porosities and bulk density were not significantly affected. Agricultural and old field areas experienced reduced water stability and both agricultural areas had lower root masses in treated plots. (See also W80-03089) (Seigler-IPA)
W80-03091

EFFECTS OF MUNICIPAL WASTEWATER IRRIGATION ON WILDLIFE AND WILDLIFE HABITAT,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
R. G. Anthony, and G. W. Wood.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 213-223, 1979. 2 Fig, 11 Tab, 8 Ref. OWRT B-059-PA(6), B-084-PA(5).

Descriptors: *Irrigation effects, *Sewage effluents, *Wildlife habitats, *Wildlife, *Vegetation effects, Deer, Song birds, Birds, Ecology, Food chains, Oak trees, Pine trees, Vascular tissues, Shrubs, Brush, Browse utilization, Plant groups, *Spray irrigation, *Land application.

Mixed oak and aspen/pine/shrub habitats were used to study the effects of waste water irrigation on vegetation and wildlife at the Pennsylvania State University Wastewater Renovation System. Results show that waste water irrigation effects are dependent on the type of habitat irrigated and the species of wildlife studied. Various animals and habitats were studied including white-tailed deer, white-footed mice, cottontail rabbits, and songbirds. Waste water irrigation on mixed oak habitats caused the establishment of lush herbaceous growth such as pokeweed which is unpalatable to deer. Suitable woody forage was reduced in the irrigated mixed-oak habitats due to ice breakage in winter and increased herbaceous competition in the summer. However, for brush and sapling stands an increase of woody forage plants would be expected due to increased sprouting from the ice breakage. Irrigation resulted in higher populations of white-footed mice in fall but not in spring, most probably because the increased food from herbaceous growth in summer disappeared in winter. Reduced stability and abundance of songbird populations was observed for irrigated areas. Also songbirds avoided irrigated areas during actual irrigation. For aspen/pine/shrub habitats these observed detrimental effects appear to be less severe than in the mixed oak habitats. A short-term study of heavy metals showed that they were not accumulated in cottontail rabbits or white-footed mice inhabiting irrigated areas. Overall no major detrimental effects on wildlife and habitats were observed due to irrigation. (See also W80-03089) (Seigler-IPA)
W80-03092

7. RESOURCES DATA

7A. Network Design

A DISCRETE MODEL FOR THE STUDY OF A LAKE,
Laboratories d'Automatique, Saint Martin D'Heres (France).
For primary bibliographic entry see Field 5C.
W80-03106

7B. Data Acquisition

MODEL DEVELOPMENT FOR PREDICTING SOIL MOISTURE BY THERMOGRAPHY,
South Dakota State Univ., Brookings. Dept. of Physics.
J. A. Tunheim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140569, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Institute South Dakota State University, Completion Report, January 1980. 58 p, 3 Fig, 2 Tab, 22 Ref, 2 Append. OWRT A-063-SDAK(1), 14-34-0001-7088.

Descriptors: *Soil moisture, Thermography, Thermal prospecting, Groundwater, Soil temperature, *Moisture content, Forecasting, Model studies, *Heat transfer.

Experimental and theoretical investigations were carried out relating to the detection and mapping of soil moisture by the use of remote sensed thermal emittance data (thermography). Soil temperature profiles, thermal emittance, soil moisture and other pertinent data were collected for test plots under fallow and crop cover conditions. Data were always collected simultaneously for two plots with identical surface conditions but one of the plots irrigated to create different soil moisture profiles. Calculations of surface temperature difference as a function of time for these soil moisture conditions were made utilizing a theoretical model. The functional form of the theoretical temperature difference with time were shown to be very close to the experimental apparent temperature difference for both crop cover and bare soil conditions. This result strongly suggests that a technique can be developed by which the effects of near surface soil moisture can be separated from the total thermal emittance data by subtracting the data component having this functional form from total thermal emittance. This component could then be used to calculate soil moisture differences for group of chosen sites. If soil moisture is measured at one site, soil moisture may be calculated for the other sites. The general nature of additional parameters needed for the present model are also described. (Wiersma-SDAK)
W80-03007

7C. Evaluation, Processing and Publication

A THREE-YEAR STUDY OF BENTHOS OF MUDDY ENVIRONMENTS IN PORT PHILLIP BAY, VICTORIA,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
For primary bibliographic entry see Field 2L.
W80-03028

CHARACTERISTICS OF SUBARCTIC SNOWCOVER,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-03034

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1978--VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, AND RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119944, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-78-1, August 1979. 415 p, 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Missouri River basin(CO), *Arkansas River basin(CO), *Rio Grande basin(CO).

Water-resources data for Colorado for the 1978 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for about 440 gaging stations; stage and contents of 25 lakes and reservoirs, 5 partial-record flow stations, 75 crest-stage partial-record stations, and 250 miscellaneous sites; water quality for 140 gaging stations and 60 miscellaneous sites; and water levels for 55 observations wells. A few pertinent stations in bordering States are also included in this report. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Kosco-USGS)
W80-03149

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1978--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119951, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-78-2, June 1979. 394 p, 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado River basin above Dolores River.

Water-resources data for Colorado for the 1978 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for about 440 gaging stations, stage and contents of 25 lakes and reservoirs, 5 partial-record flow stations, 75 crest-stage partial-record stations, and 250 miscellaneous sites; water quality for 140 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Kosco-USGS)
W80-03150

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1978--VOLUME 3. DOLO-

RES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119969, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CO-78-3, June 1979. 440 p, 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Dolores River basin, *Green River basin, *San Juan River basin.

Water-resources data for Colorado for the 1978 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for about 440 gaging stations, stage and contents of 25 lakes and reservoirs, 5 partial-record flow stations, 75 crest-stage partial-record stations, and 250 miscellaneous sites; water quality for 140 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (Kosco-USGS)
W80-03151

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1978--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115686, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OH-78-1, August 1979. 383 p, 2 Fig.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Ohio River basin.

Water resources data for the 1978 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 168 gaging stations, stage and contents at 32 lakes and reservoirs, water quality at 58 gaging stations and 54 wells, and water levels at 39 observation wells. Also included are data for 60 crest-stage partial-record stations and 36 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (Kosco-USGS)
W80-03152

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1978--VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115694, Price codes: A10 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OH-78-2, August 1979. 202 p, 2 Fig.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *St Lawrence River basin(Ohio).

Water resources data for the 1978 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 168 gaging stations, stage and contents at 32 lakes and reservoirs, water quality at 58 gaging stations and 54 wells, and water levels at 39 observation wells. Also included are data for 60 crest-stage partial-record stations and 36 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (Kosco-USGS)
W80-03153

QUALITY OF RIVERS OF THE UNITED STATES, 1975 WATER YEAR--BASED ON THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN),
Geological Survey, Reston, VA. Water Resources Div.
J. C. Briggs, and J. F. Ficke.
Geological Survey open-file report 78-200, May 1977. 436 p, 25 Fig, 14 Tab, 25 Ref.

Descriptors: *Water quality, *Rivers, *United States, *Networks, *Data collections, *Streams, Water temperature, Chemical analysis, Dissolved solids, Sedimentation, Geology, Precipitation(Atmospheric), Water pollution, Nutrients, Specific conductivity, Nitrogen, Phosphorus, Plant populations, Bacteria, Heavy metals, Phytoplankton, Periphyton, Carbon, Radioactivity, Hardness(Water), Biota, Pesticides, Trace elements, Soils, Agriculture, *NASQAN.

The National Stream Quality Accounting Network (NASQAN) was established by the U.S. Geological Survey to provide a nationally uniform basis for continuously assessing the quality of U.S. rivers. Stations generally are at the downstream end of hydrologic accounting units in order to measure the quantity and quality of water flowing from the units. Data are available on a large number of water-quality constituents measured at 345 stations during the 1975 water year. Temperature data (usually continuous or daily measurements) from NASQAN stations were fitted to a first order harmonic equation and the parameters for the harmonic function are reported for each station. Considering chemical and biological characteristics of U.S. streams as described by NASQAN data, water quality is best (by many standards) in the Northeast, Southeast, and Northwest. Many of these waters show the effects of pollution and carry moderate or high levels of major nutrients. High counts of indicator bacteria also show signs of local pollution. In the Northeast, some heavy metals are at moderate levels, but not above most water-quality criteria. Rivers of most of the Mid-Continent and Southwest reflect the arid or semi-arid climate, erodible soils, and agricultural activities. A special analysis was made to study the patterns of dissolved solids, major nutrients, phytoplankton, and zinc in the Mississippi River above Memphis, Tennessee. (Kosco-USGS)
W80-03154

POTENTIOMETRIC SURFACE OF THE MISSISSIPPIAN AQUIFER IN PARTS OF TRIGG, LYON, CALDWELL, AND CHRISTIAN COUNTIES, MISSISSIPPIAN PLATEAU REGION, KENTUCKY,
Geological Survey, Paducah, KY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-03155

WATER-RESOURCES DATA, 1970-75, FOR PERRIS VALLEY AND VICINITY, RIVERSIDE COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. J. Lang.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Printed copy $17.25, microfiche $3.50. Geological Survey open-file report 79-1256, August 1979. 127 p, 8 Fig, 6 Tab, 19 Ref.

Descriptors: *Water resources, *Hydrologic data, *Investigations, *Data collections, Rural areas, Land use, Urbanization, Peak discharge, Precipitation(Atmospheric), Groundwater, Water levels, Water quality, Sediment yield, Storm runoff, Climates, Streamflow, Surface waters, Crest-stage gages, Flood stages, Gaging stations, Rainfall-runoff relationships, Water wells, California, *Perris Valley(CA), *Riverside County(CA).

In 1969 the U.S. Geological Survey began in Perris Valley, Calif., to determine changes in the hydrologic regime as a rural area becomes urbanized. The investigations spanned several years when precipitation was below normal in most of southern California. Surface-water records were collected for a 6-year period at 21 sites, and continuous precipitation records were obtained at four sites. Ground-water levels were tabulated from historical data at selected wells for 1941, 1968, and 1970. Water quality was monitored at several wells in the valley, and sediment data were collected at three surface-water gages. There was little increase in urbanization during the investigation. (Kosco-USGS)
W80-03156

HYDROLOGIC DATA FOR FLOODS OF JULY 1978 IN SOUTHEAST MINNESOTA AND SOUTHWEST WISCONSIN,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-03158

NEBRASKA WATER-DATA PROGRAMS, 1979.
Geological Survey, Lincoln, NE. Water Resources Div.
Available from OFSS U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225. Paper copy $16.25, microfiche $3.50. Geological Survey open-file report 79-1341, 1979. 121 p, 2 Fig, 1 Tab, 68 Ref, 11 Append.

Descriptors: *Nebraska, *Hydrologic data, *Projects, *Planning, *Publications, Measurement, Streamflow, Sites, Water quality, Groundwater, Floods, Flood plain insurance, Gaging stations, Chemical analysis.

This report contains descriptions of 37 projects of the U.S. Geological Survey and of State agencies represented on the Nebraska Water Data-Coordination Committee. The descriptions include title, name of project leader, agency or agencies involved, statements of the problems and objectives, reports resulting from the project, and plans for 1979. Sources of water-related information are given with names, addresses, and telephone numbers. Also given is a list of selected, relatively recent publications pertaining to Nebraska. Appendices include current measuring sites for streamflow, water quality, and ground-water levels; an index to published streamflow records; a list of flood-prone area maps for Nebraska; and a list of communities participating in the Federal Insurance Administration (FIA) flood-insurance program. (Kosco-USGS)
W80-03159

OCCURRENCE, QUALITY, AND QUANTITY OF GROUND WATER IN WILBARGER COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
R. D. Price.
Report 240, November 1979. 241 p, 34 Fig, 11 Tab, 57 Ref.

Descriptors: *Groundwater, *Data collections, *Texas, *Water quality, *Aquifers, Groundwater

availability, Water supply, Aquifer characteristics, Water table, Water levels, Well data, Test wells, Drillers logs, Hydrogeology, Water properties, Chemical analysis, Dissolved solids, Hardness(Water), Chlorides, Iron, Nitrates, Transmissivity, Aquifer systems, Geology, Boron, Precipitation(Atmospheric), Evaporation, Brine disposal, Springs, *Wilbarger County(TX).

Wilbarger County, 954 square miles in area, is located in extreme northcentral Texas and entirely within the Osage section of the Central Lowlands physiographic province. The area lies within the Red River drainage basin with the Red River forming its north boundary and the Pease River dissecting the county and flowing northeast through the central part of the county. The water-bearing units listed in their order of importance are: the Seymour Formation, Quaternary alluvium deposits, and the rocks of the Permian System. The Seymour Formation and Quaternary alluvium deposits are hydrologically connected and usually function as a single aquifer. The yields of the wells range from small to moderate. The quality of their groundwaters ranges from fresh to very saline. Groundwaters of the Clear Fork Group of Permian age are of small yields and are usually highly mineralized. The San Angelo Formation of Permian age reliably yields fresh to slightly saline groundwater in small quantities. Groundwater in Wilbarger County is used for municipal, irrigation, rural domestic, livestock, and industrial purposes. The native groundwater in the principal aquifer in the county, although very hard, is of good quality. Water from this aquifer is suitable for public supplies, irrigation, livestock, and limited industrial uses. (Humphreys-ISWS)
W80-03209

8. ENGINEERING WORKS

8A. Structures

EXTENDED SET OF COMPONENTS IN PIPE NETWORKS,
Waterloo Univ. (Ontario). Dept. of Systems Design.
For primary bibliographic entry see Field 8B.
W80-03194

ARMOUR UNIT FOR WAVE ENERGY ABSORPTION,
C. T. Brown.
U.S. Patent No 4,172,680, 10 p, 23 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 5, p 1179-1180, October 30, 1979.

Descriptors: *Patents, *Breakwaters, *Barriers, Coastal structures, Shore protection, Concrete structures, Waves(Water).

A breakwater, or similar structure, is comprised of a core of rubble, and an armouring layer overlying the core. The armouring layer is composed of individual armour units of hexagonal outer cross-section arranged in a honeycomb array. Each of the armour units has an elongated, concrete body with longitudinal through water-passage means so that the porosity of the exposed face of the armouring layer is solely determined by the ratio of the cross-sectional area of the water passage means to the cross-sectional area of the concrete body. (Sinha-OEIS)
W80-03207

8B. Hydraulics

SLURRY FLOW IN PIPE NETWORKS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
D. J. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15132, p 57-70, January 1980. 3 Fig, 3 Tab, 5 Ref, 2 Append.

Descriptors: *Hydraulic transportation, *Slurries, *Pipelines, Networks, Network design, Pipe flow, Steady flow, Hydraulics, Computer programs, Equations, *Two-phase flow, Coal transportation.

The basic equations for steady-state flow of a solid-liquid slurry in a network of pipes were developed. The equations were expressed in terms of unknown flow rates and solids concentrations for each pipe in the network. Two sets of simultaneous algebraic equations were obtained. These are nonlinear, and a direct solution of the equation sets is not possible. A procedure for solving the equations based on linearization of nonlinear terms was described. This procedure requires several trials and converges rapidly. A computer program was developed based on the proposed method and an example system was analyzed using this program, and the results were presented. (Lee-ISWS)
W80-03193

EXTENDED SET OF COMPONENTS IN PIPE NETWORKS,
Waterloo Univ. (Ontario). Dept. of Systems Design.
M. Chandrashekar.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15130, p 133-149, January 1980. 11 Fig, 6 Tab, 7 Ref.

Descriptors: *Networks, *Network design, *Water distribution(Applied), Economic efficiency, Economic justification, Graphical analysis, Pipe flow, Pumps, Valves, Computer programs, Equations, *Check valves, Economic analysis, Matrix methods, Pressure reduction, Sparse matrix method.

Models for an extended set of components encountered in water-distribution systems were developed based on graph theoretic concepts. It is shown that components such as check valves, pressure-reducing valves, and booster pumps may be included in the system of equations in which junction (nodal) heads are being solved by selecting appropriate admittance values (similar to those associated with simple pipes) indicated by the current operating conditions of the valves. The formulation-solution procedure is based on sparse matrix methods that leads to efficient and economical analysis of water-distribution systems on a digital computer. (Lee-ISWS)
W80-03194

8D. Soil Mechanics

EVALUATION OF MOUND SYSTEMS FOR RENOVATION OF SEPTIC TANK EFFLUENT,
Institute for Research on Land and Water Resources Pennsylvania State Univ., University Park. Dept. of Agronomy.
G. W. Petersen, and D. D. Fritton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140858, Price codes: A06 in paper copy, A01 in microfiche. Research Project Technical Completion Report, Pennsylvania State University, Dec 1979, 102 p, 19 Fig, 9 Tab, 45 Ref, OWRT B-98-PA (3) 14-34-0001-7129.

Descriptors: *Permeability, *Pennsylvania, Flow, Laboratories, *Soils, Sites, Design, *Sewage disposal, *Septic tanks, *Construction, *Maintenance, Chemical analysis, Infiltration, Effluents, Adsorption, Percolation, *Elevated sand mounds, *Renovation, Fill materials, *Questionnaire, *Malfunction rates, Column studies, Pressurized distribution, Sand-clay mixtures, On-site disposal.

Elevated sand mounds were introduced in 1974 and are currently widely used in Pennsylvania for on-site domestic waste disposal. This report describes the project undertaken to assess the effectiveness of the systems and to determine the varied conditions under which the systems succeed or fail. Data from questionnaire and field studies indicated that a considerable number of elevated mound systems are malfunctioning throughout Pennsylvania. The rate of malfunction varied regionally and was related to placement of systems on unsuitable sites, construction problems, and to unsuitable soil and site characteristics not defined in the regulations. In some areas, the designed lateral-plus-vertical flow capabilities were insufficient to dissipate the effluent resulting in malfunctions on sites found suitable under current regulations. Laboratory studies indicated that with sufficient effluent dissipation, adequate renovation should occur within and beneath the mound systems. Column studies showed that the presence of clay in quantities currently meeting PDER standards in a sandy fill did not significantly improve the renovation of septic tank effluent. Siting, design, construction and maintenance recommendations were made for Pennsylvania elevated sand mounds. Many of these recommendations are currently being implemented into the latest revisions of the on-site domestic waste disposal standards of the Department of Environmental Resources.
W80-03001

8F. Concrete

ARMOUR UNIT FOR WAVE ENERGY ABSORPTION,
For primary bibliographic entry see Field 8A.
W80-03207

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

GROUNDWATER: NEW DIRECTIONS--WHERE WE'VE BEEN AND WHERE WE'RE GOING,
For primary bibliographic entry see Field 2F.
W80-03037

THE MEINZER ERA OF U.S. HYDROGEOLOGY, 1910-1940,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2F.
W80-03054

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 4.
Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W80-03208

10D. Specialized Information Center Services

NETWORKS AND INFORMATION SYSTEMS FOR DEALING WITH DROUGHT,
Clark Univ., Worcester, MA.
L. Berry, and R. B. Ford.
In: Proceedings Symposium on Drought in Botswana, June 5-8, 1978, Gaborone. Published by the Botswana Society in collaboration with Clark University Press. p 165-172, 1979. 2 Tab, 1 Ref.

Descriptors: *Droughts, *Information exchange, *Networks, Planning, Regional analysis, Botswana, Planning, Environment, Monitoring.

This paper outlines information important in dealing with drought as (1) western scientific information, (2) ethno-scientific information, and (3) know-how, or informal technical information. The difficulty of use of diverse sources of environmental information would seem to lie in the translation of a mass of even well-ordered and closely documented scientific information into specific development projects. The authors believe that Botswana is in a position of strength from three kinds of information: environmental, natural resource, and drought. Experience has already been gained there in the use of remote sensing for assessing the status of and monitoring change in national resources. Botswana's Tribal Grazing Lands Programme has demonstrated that in rural areas, local people understand

their local environment and keep track of changes within it. If experiments encouraging simple monitoring of key environmental components, perhaps through schools and/or the establishment of low-cost environmental/drought assessment units composed of part-time people from key ministries and institutions, a great step forward will have been taken toward the use of information in planning. (Tickes-Arizona)
W80-03071

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SELECTED WATER RESOURCES ABSTRACTS

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The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

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1. NATURE OF WATER

1A. Properties

PROCESS FOR CATALYTIC PHOTO-OXIDATION OF WATER,
National Research Development Corp., London (England). (Assignee).
A. Harriman, and G. Porter.
US Patent No 4,176,026, 12 p, 3 Fig, 3 Tab, 2 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1039, November 27, 1979.

Descriptors: *Patents, *Solar radiation, *Oxidation, Energy conversion, Light, Water treatment, Oxygen, Chemical reactions, Manganese, Photooxidation, Chemical fuel.

The object of the invention is to provide a process by means of which visible light can be used to photo-oxidise water into oxygen and in which the electrons which are released from the water in such a process are captured by an electron acceptor to form a compound which acts as a store of energy and which may subsequently be used as, or converted to, a chemical fuel. The process comprises irradiating with light in the visible region of the spectrum a solution comprising water, a manganese (II) or manganese (III) complex of formula MnL wherein L is a phthalocyanine ligand, a 5, 10, 15, 20--tetraphenylporphyrin ligand or a 5, 10, 15, 20--tetrapyridylporphyrin ligand, and a suitable electron acceptor. The process results in the oxidation of water into oxygen and the reduction of the electron acceptor. The reduced electron acceptor may be used as, or converted to, a chemical fuel. (Sinha-OEIS)
W80-03440

VEGETATION AND NUTRIENT STATUS OF NORTHERN MICHIGAN FENS,
Michigan Univ., Pellston. Biological Station.
For primary bibliographic entry see Field 2I.
W80-03523

1B. Aqueous Solutions and Suspensions

THE EFFECT OF SALINITY ON GEOTHERMAL WELL PERFORMANCE,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 8B.
W80-03430

METHOD OF GENERATING HYDROGEN AND OXYGEN FROM WATER,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). (Assignee)
H. Barnert, J. Divisek, and W. Faul.
U.S. Patent No 4,175,013, 6 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 3, p 692, November 20, 1979.

Descriptors: *Patents, *Chemical reactions, *Electrolysis, Gases, Hydrogen, Oxygen, Electrolytes, Organic compounds.

A method of generating oxygen and hydrogen from water is described in which an acidic electrolyte containing formaldehyde is electrolyzed and produces oxygen and a gas which contains a low molecular-weight hydrocarbon. The low molecular-weight hydrocarbon is subjected to a catalytic conversion with water to produce synthesis gas consisting predominantly of hydrogen and carbon monoxide which are reacted to yield methanol. The methanol, in turn, is reacted to produce formaldehyde which is introduced into the electolysis itself and hydrogen which is recovered. (Sinha-OEIS)
W80-03550

2. WATER CYCLE

2A. General

HYDROLOGIC LAND USE CLASSIFICATION USING LANDSAT,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 7B.
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RESERVOIR STORAGE DETERMINATION BY COMPUTER SIMULATION OF FLOOD CONTROL AND CONSERVATION SYSTEMS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-03348

DETERMINING PEAK-DISCHARGE FREQUENCIES IN AN URBANIZING WATERSHED--A CASE STUDY,
Corps of Engineers, Detroit, MI. Detroit District.
S. F. Daly, and J. Peters.
Hydrologic Engineering Center, Davis, California, Technical Paper No 64, July 1979. 13 p, 12 Fig, 4 Tab, 12 Ref.

Descriptors: *Urbanization, *Urban hydrology, *Peak discharge, *Michigan, Hydrograph analysis, Frequency analysis, Frequency curves, Flood recurrence interval, Unit hydrographs, Watersheds(Basins), Analytical techniques, Analysis, Infiltration, Runoff, Rainfall-runoff relationships, Computer models, *Red Run Drain(MI), Case study, Ungaged area, Impervious surfaces.

A case study was presented of a hydrologic investigation of the Red Run Drain-Lower Clinton River watershed, an area near Detroit, Michigan, that has undergone urbanization since the 1940s. The purpose of the study was to determine peak-discharge frequencies at gaged and ungaged locations for existing and future conditions. Population density was used as an indicator of urbanization in relationships defining unit hydrograph parameters and hydrologically significant impervious area. Input parameters for a single event rainfall-runoff simulation model (HEC-1) were developed to reflect watershed conditions in the years 1940, 1950, 1960, and 1975. The input parameters were verified by reconstructing observed flood events that occurred at these points in time. Sets of synthetic winter and summer storm hyetographs were input to HEC-1 to develop a series of curves for two gaging stations that relate peak discharge to magnitude of synthetic storm for each watershed condition. The curves were used to transform the series of recorded annual peak discharges at each gage to a stationary series that reflects 1975 watershed conditions. Discharge frequency estimates were then developed for ungaged locations using winter and summer synthetic storms that were assigned exceedance frequencies consistent with actual exceedance frequencies at the gaged locations. Projections of future population density were the basis for developing HEC-1 input parameters representing years 2000 and 2025 watershed conditions. Estimates of peak discharge-frequencies for the future conditions were made at the gaged and ungaged locations using the methods described above. (Humphreys-ISWS)
W80-03349

FLOOD HYDROGRAPH AND PEAK FLOW FREQUENCY ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
A. D. Feldman.
Technical Paper No 62, March 1979. 19 p, 4 Fig, 1 Tab, 37 Ref.

Descriptors: *Hydrograph analysis, *Peak discharge, *Watersheds(Basins), *Floods, Analytical techniques, Hydrographs, Model studies, Frequency analysis, Streamflow forecasting, Flood frequency, Hydrologic systems, Runoff, Ungaged areas.

This paper addressed the practical state of the art of techniques to predict flood peaks and their associated frequency of occurrence, and techniques for predicting critical flood hydrographs (or series of hydrographs) and their frequencies of occurrence. Statistical relationships, empirical equations, and watershed models were investigated as means for predicting the peak discharges and flood hydrographs. In general, the larger or more complex the drainage system becomes, the more the analysis shifts from predicting peaks to predicting the whole hydrograph. The techniques addressed in this paper were separated into the following categories: (1) frequency analysis of historical streamflows, (2) statistical equations, (3) empirical formulae, (4) single event watershed models, and (5) continuous watershed models. (Humphreys-ISWS)
W80-03350

TESTING OF SEVERAL RUNOFF MODELS ON AN URBAN WATERSHED,
Hydrologic Engineering Center, Davis, CA.
J. Abbott.
Technical Paper No 59, October 1978. 50 p, 15 Fig, 11 Tab, 15 Ref.

Descriptors: *Urban runoff, *Model studies, *California, *Watersheds(Basins), Computer models, Storm runoff, Routing, Hydrographs, Discharge(Water), Storm water, Management, Calibrations, Surface runoff, Hydrologic aspects, Hydrology, Unit hydrographs, Monthly, Analytical techniques, Castro Valley Watershed(CA), Urban watersheds, Daily runoff.

Six models, plus two variants of one and a variant of another, were tested with the objective of making a preliminary evaluation of their relative capabilities, accuracies, and ease of application. For four of the models, plus two variants of one of them, the primary performance criterion was the degree to which simulated values matched observed daily and monthly runoff volumes for the 5.5-square mile Castro Valley Watershed near Oakland, California. In addition, tests were performed for several individual runoff events for all six models. The results showed that each model could be calibrated on a single set of data and verified with acceptable accuracy on a different data set. The ease of application was decidedly different for all models, due to the differing level of detail in input data required. Going from the simplest to most difficult to apply, the continuous models rank as follows: STORM, HEC-1C, SSARR, and HSP. Similar ranking of the single-event models is: HEC-1, SWMM, and MITCAT. Also, a recent capability added to the STORM model (i.e., SCS procedures for computing runoff and routing) produced more accurate results than the coefficient method of computing quantity of runoff incorporated in the original version of STORM. These limited tests were not intended to serve as a basis for comparison of the accuracy of the various models. However, they did show that the more complex models did not produce better results than the simple models for the Castro Valley Watershed data. (Humphreys-ISWS)
W80-03352

SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-03353

LAND-USE AND UPLAND WATER RESOURCES IN BRITAIN--A STRATEGIC LOOK,
Institute of Hydrology, Wallingford (England).
I. R. Calder, and M. D. Newson.
Water Resources Bulletin, Vol 15, No 6, p 1628-1639, December 1979. 4 Fig, 3 Tab, 41 Ref.

Descriptors: *Forest watersheds, *Rainfall disposition, *Interception, *Water yield, Runoff, Reservoirs, Water supply, Water resources, Evaporation, Evapotranspiration, Watersheds(Basins), Forests, Vegetation establishment, Land use, On-site investigations, Mathematical models, Model studies, Hydrology, *England.

Recent results from the Institute of Hydrology's hydrometeorological and hydrological studies on

water use by forest and grassland confirm earlier predictions of a reduction in water yields following afforestation. This reduction is due primarily to the increased interception losses from forests. This paper showed how the water yield from uplands is related to the relative proportions of land under forest and hill farming, and estimated how water yields will change if a greater proportion of hill land is afforested. (Sims-ISWS)
W80-03363

SCIENTIFIC ASPECTS OF THE 1975-76 DROUGHT IN ENGLAND AND WALES,
For primary bibliographic entry see Field 2E.
W80-03444

SOME DETAILED WATER BALANCE STUDIES OF RESEARCH CATCHMENTS,
Institute of Hydrology, Wallingford (England).
R. T. Clarke, and M. D. Newson.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. p 21-42, 1978. 6 Fig, 7 Tab.

Descriptors: *Demonstration watershed, *Water balance, *Water yield, *Droughts, Forest watersheds, Agricultural watersheds, On-site investigations, Data collections, Water levels, Vegetation effects, Groundwater, Soil moisture, Evaporation, Rainfall, Watersheds(Basins), Hydrology, Foreign research, Land use, Precipitation(Atmospheric), Analysis, Streamflow, Aquifers, Discharge(Water), *England, *Wales.

Aspects of the water balance during the drought period 1975-76 were reported for the Institute of Hydrology's experimental catchments in Cumbria, East Anglia, the Thames Valley, and upland Wales. Summer (April-September) and winter (October-March) totals of precipitation, streamflow, and potential evaporation during the drought were compared with mean values for seasons preceding it; where soil moisture was measured by neutron probe, losses from actual evaporation were also compared. Yield dropped proportionately less in relation to rainfall where catchments contained appreciable storage, such as the Cam catchment in East Anglia with its chalk-glacial drift aquifer, or the Wye and Severn catchments in upland Wales which contain storage areas of peat underlain with glacial drift. The stream draining the Oxford clay of the Ray catchment in the Thames valley, on the other hand, dried up entirely in the second summer of the drought. The paper suggested that the comparison of water yields from the Wye and Severn catchments, which are under hill pasture and coniferous forest respectively, gives results which have considerable bearing on the future management of water resources from upland areas when the aim of management is to maintain supplies of water even during periods of drought as extreme as the years 1975-76. The effect on reservoir operation of neglecting to allow for change in land use is illustrated by a hypothetical example using an artificial 30-year streamflow sequence containing a drought year with very long return period. (See also W80-03444) (Humphreys-ISWS)
W80-03446

THE EFFECTS OF DROUGHT ON THE RIVER SYSTEMS,
Birmingham Univ. (England). Dept. of Water Engineering.
M. J. Hamlin, and C. E. Wright.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. p 69-96, 1978. 10 Fig, 9 Tab, 15 Ref.

Descriptors: *Droughts, *River systems, *Watersheds(Basins), *Mathematical models, Runoff, Rainfall, Streamflow, Streamflow forecasting, Statistical methods, Analytical techniques, Rivers, Evaporation, Foreign research, Data collections, Frequency analysis, Hydrographs, Low-flow frequency, Low flow, Reservoir storage, Moisture deficit, Model studies, *England, *Wales, Watershed characteristics.

The drought of 1975-76 had a significant effect on the river systems of England and Wales and will be used in water resources design for many years. It is therefore important to recognize that for the river flows it was not uniformly severe. Further, for many purposes, the duration of the low flow is at least as important as its severity. As an example, for the river Thames at Teddington it was only for periods of one and two months that the flow in 1976 was lower than that in 1921. The paper reviewed the conditions that give rise to low flows in rivers, compared a representative set of low flow records, commented on criteria that were used to reduce the effect of the drought on the quantity and quality of river flows, and suggested methods by which the management of rivers in time of drought might be improved. What is necessary is to present the information in terms that show clearly the consequences of particular courses of action given clearly stated probabilities of future rainfall or river flows. This will enable logical decisions to be taken. This may be attempted in one of three ways: the use of data generation techniques, the use of rainfall statistics where these are easier to obtain than adequate river flow data, or the use of flow records where they are of sufficient length to permit realistic statistical analysis. The use of rainfall statistics, if it is possible to derive a satisfactory rainfall runoff model, gives the most promising method and warrants further research and development. (See also W80-03444) (Humphreys-ISWS)
W80-03448

PLANNING FOR DEVELOPMENT OF GROUNDWATER AND SURFACE WATER RESOURCES,
Central Water Planning Unit, Reading (England).
For primary bibliographic entry see Field 2E.
W80-03450

A SYSTEMS MODEL OF STREAM FLOW AND WATER QUALITY IN THE BEDFORD-OUSE RIVER--1. STREAM FLOW MODELLING,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W80-03456

THE APPLICATION OF HYDROLOGIC MODELS TO SMALL WATERSHEDS HAVING MILD TOPOGRAPHY,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B.
W80-03469

CURRENT SUBSURFACE INTRUSION OF MEDITERRANEAN SEAWATER--A POSSIBLE SOURCE OF GROUNDWATER SALINITY IN THE RIFT VALLEY SYSTEM, ISRAEL,
Geological Survey of Israel, Jerusalem.
U. Kafri, and A. Arad.
Journal of Hydrology, Vol 44, No 3/4, p 267-287, December 1979. 8 Fig, 2 Tab, 42 Ref.

Descriptors: *Saline water, *Groundwater resources, *Chemical properties, *Saline water-freshwater interfaces, *Geohydrologic units, Groundwater, Aquifer systems, Isotope studies, Mixing, Geochemistry, Paleohydrology, Geologic history, Sea water, Saline water intrusion, *Galilee(Israel), *Israel, Flushing.

Various theories have been put forward regarding the salination mechanism in the Jordan-Dead Sea Rift Valley and its branching valleys. None of these has suggested current subsurface seawater penetration to the internally drained Judea Group aquifer as a part of the system. The hydrogeological configuration is a combination of a low water table and a rather low groundwater divide, resulting in a shallow sea-fresh water interface. In most of the area the interface is expected to be situated above the base of the aquifer. As a result, current seawater intrusion is possible across the groundwater divide through the Yizre'el and Beersheva valleys which dissect Israel and connect the Mediterranean and the Jordan-Dead Sea Rift Valley. The model suggested herein is in accordance with, or cannot be rejected on the basis of, the chemistry and isotope composition of the saline waters. In the highly flushed aquifers of the internal valleys, brackish water with marine affinity suggests current infiltration of seawater. This mechanism is additional to other sources, such as deep seated, highly concentrated brines and entrapped fossil seawater, all of which are diluted by the flow of cyclic freshwaters. (Adams-ISWS)
W80-03472

THE PALEOHYDROLOGY OF SOUTHERN ISRAEL AND ITS INFLUENCE ON THE FLUSHING OF THE KURNUB AND 'ARAD GROUPS (LOWER CRETACEOUS AND JURASSIC),
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Research.
A. Issar.
Journal of Hydrology, Vol 44, No 3/4, p 289-303, December 1979. 7 Fig, 23 Ref.

Descriptors: *Saline water, *Aquifer systems, *Chemical properties, *Geohydrologic units, *Paleohydrology, Groundwater, Groundwater resources, Isotope studies, Mixing, Geochemistry, Geologic history, *Negev(Israel), *Israel, Flushing.

The ionic composition, stable isotope, and total salinity pattern of waters from the aquifer of the Kurnub and 'Arad groups (Lower Cretaceous-Jurassic) suggest that these waters replaced previous formation brines. The hydrologic regime which caused the flushing is the same as that which filled the Kurnub Group aquifer ('Upper Nubian Sandstone') of the central and southern Negev. Infiltration took place during humid phases of the Pleistocene, through outcrops along the igneous massif of the southern Sinai. Northward, subsurface flow was made possible mainly by the opening of outlet zones along the regional faults accompanying the Syrian-African rift system. The layers beneath the Coastal Plain were not flushed as no outlet was available due to the deep burial of these layers under a thick impermeable cover of the Shefela and Saqiye groups. Alternative models by other authors (Mesozoic and Recent flushing) are briefly discussed. (Adams-ISWS)
W80-03473

HYDROMETEOROLOGICAL MODEL FOR STREAMFLOW PREDICTION,
Geological Survey, Tacoma, WA. Water Resources Div.
W. V. Tangborn.
Available from: OFSS U.S. Geological Survey Box 25425, Federal Center Denver, CO microfiche $3.50 paper copy $12.00. Geological Survey open-file report 79-741, 1979. 88 p, 11 Fig, 7 Tab, 3 Ref, 9 Append.

Descriptors: *Streamflow forecasting, *Model studies, *Hydrology, *Meteorology, *Washington, Hydrologic data, Methodology, On-site data collections, Water storage, River basins, Rainfall-runoff relationships, Snowmelt, *North Cascades region(Wash).

The hydrometeorological model described in this manual was developed to predict seasonal streamflow from water in storage in a basin using streamflow and precipitation data. The model, as described, applies specifically to the Skokomish, Nisqually, and Cowlitz Rivers, in Washington State, and more generally to streams in other regions that derive seasonal runoff from melting snow. Thus the techniques demonstrated for these three drainage basins can be used as a guide for applying this method to other streams. Input to the computer program consists of daily averages of gaged runoff of these streams, and daily values of precipitation collected at Longmire, Kid Valley, and Cushman Dam. Predictions are based on estimates of the absolute storage of water, predominately as snow: storage is approximately equal to basin precipitation less observed runoff. A pre-forecast test season is used to revise the storage estimate and improve the prediction accuracy. To obtain maximum prediction accuracy for operational applications with this model, a systematic evaluation of

several hydrologic and meteorologic variables is first necessary. Six input options to the computer program that control prediction accuracy are developed and demonstrated. Predictions of streamflow can be made at any time and for any length of season, although accuracy is usually poor for early-season predictions (before December 1) or for short seasons (less than 15 days). The coefficient of prediction (CP), the chief measure of accuracy used in this manual, approaches zero during the late autumn and early winter seasons and reaches a maximum of about 0.85 during the spring snowmelt season. (Kosco-USGS)
W80-03487

WATER RESOURCES OF THE NISQUALLY LAKE AREA, PIERCE COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
H. E. Pearson, and N. P. Dion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 953, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-101, May 1979. 34 p, 6 Fig, 7 Tab, 20 Ref.

Descriptors: *Groundwater resources, *Surface-groundwater relationships, *Model studies, *Groundwater availability, *Streams fisheries, Chemical analysis, Water temperature, Data collections, Discharge measurements, Hydrologic cycle, Glacial drift, Till, Water quality, Drilling, Test wells, Bathymetry, Washington, *Nisqually Lake area(Wash), *Pierce County(WA), Fort Lewis, Nisqually Indian Reservation.

This report presents data on the water resources of an area within, and adjacent to a part of the Fort Lewis Military Reservation, Wash., that prior to 1917 was included in the Nisqually Indian Reservation. The only surface-water bodies of significance in the study area are Muck Creek and Nisqually Lake. A large spring also is in the study area. Development or diversion of Muck Creek near its mouth would provide sufficient water for a small to medium sized fish-rearing facility. The highest water temperature recorded during the 25 months of data collection was 14C in August 1977 for Muck Creek. Nisqually Lake has a surface area of about 89 acres and is shallow with a flat bottom. Species of warm-water fish are probably best suited for the lake. Ground water occurs in unconsolidated glacial drift or outwash of gravel, sand, silt, and clay. Drilling of test wells is required to provide more reliable data on yields of ground water. (Kosco-USGS)
W80-03494

BIOGEOGRAPHICAL CONSIDERATIONS OF COLONIZATION OF THE LOWER TILEMSI VALLEY IN THE SECOND MILLENIUM B.C.,
Cape Town Univ. (South Africa). Dept. of Archaeology.
A. B. Smith.
Journal of Arid Environments, Vol 2, No 4, p 355-361, Dec 1979. 2 Fig, 25 Ref.

Descriptors: *Biogeography, *Migrations, *Sahara, *Mali, *Paleoclimatology, History, Social aspects, Rural sociology, Model studies, Droughts, Water supply, Africa.

Pastoral peoples of the Saharan and Sahel zones of West Africa have been subjected to fluctuating environmental conditions since the introduction of domestic animals into North Africa c. 7000 P.B. The present paper attempts to create a dynamic model of the palaeoenvironmental situation in the Sahel and, from archaeological data excavated in the Tilemsi Valley, Mali, offers an example of human response to these fluctuating conditions which illustrated how these people responded to drought by always moving south into better-watered areas. Expansion of the pastoral way of life in the Sahara before 6500 P.B. is postulated to have been tied closely to annual precipitation and evapotranspiration. Increasing instability in this dynamic equilibrium by 4500 B.P., however, is thought to have precipitated the decision to migrate to where sufficient water and pasturage would be available. Colonization is further postulated to have been due to a number of other coincident factors, including a gradual southward movement of the savanna zone and the concomitant retreat of the Tsetse belt. (Tickes-Arizona)
W80-03553

2B. Precipitation

TEXAS HIPLEX INTERIM PROGRESS REPORT FOR APRIL 1 - SEPTEMBER 30, 1979.
Texas Dept. of Water Resources, Austin. Planning and Development Div.
Report No LP-110, December 1979 Prepared for the Bureau of Reclamation, Office of Atmospheric Resources Management. 138 p, 10 Fig, 14 Tab, 2 Append.

Descriptors: *Weather modification, *Cloud seeding, *Texas, *Precipitation(Atmospheric), Cloud physics, Climatology, Satellites(Artificial), Data collections, Climatic data, Artificial precipitation, Synoptic analysis, Meteorological data, Weather data, High Plains Cooperative Program.

An evaluation of the 1979 operation season is presented along with a continued description of 1976-1978 operations for the Texas HIPLEX Project (High Plains Cooperative Program). The project, begun in 1974 by the Bureau of Reclamation Office of Atmospheric Resources Management and the Texas Water Development Board, is designed to establish a verified, working technology and operation management framework capable of producing additional rain from cumulus clouds in the semiarid Plains States. Three field research sites are being used and the one evaluated here is the Big Spring-Snyder area of Texas. Cloud and precipitation processes associated with natural and seeded clouds in the area are being studied. Progress reports on mescoscale data evaluation are given along with synoptic climatology development, satellite radiance data analysis, radar data analysis and interpretation, and cloud-sampling with seeding operations. Mesoscale data for 1978 are similar to 1976 and 1977 data. The major parameter determining suitable cloud seeding environment in the area is moisture. A comprehensive satellite imagery and radiance data analysis is being prepared for 1976 through 1978. Digitized M-33 radar tapes data are also being analyzed for later combination with previous years results. (Seigler-IPA)
W80-03319

TEXAS HIPLEX 1979 FIELD OPERATIONS SUMMARY,
Texas Dept. of Water Resources, Austin.
W. O. Alexander, and R. F. Riggio.
Report No LP-112, January 1980. 398 p, 5 Tab, 1 Append.

Descriptors: *Texas, *Weather modification, *Weather data, *Cloud seeding, Cloud physics, Meteorology, Precipitation(Atmospheric), Rain, Weather forecasting, Aircraft, Application equipment, High Plains Cooperative Program(HIPLEX).

Daily summaries of 1979 Texas HIPLEX (High Plains Cooperative Program) Field Program are provided for each day from May 21 through July 20 in chronological order. Summary tables are presented for the 1979 Texas HIPLEX field season, aircraft flight operations, and all Texas HIPLEX related cloud-seeding activities. Information given includes when and where cloud sampling and/or seeding was done and when aircraft, radar, rawisonde, and special surface data were collected. Daily weather summaries are given for the period along with surface and airborne weather observations and equipment status. With each daily weather summary is a log of observed weather conditions generally made hourly from 0800 to 1700 CDT from the Big Spring Meteorological Facility. Aircraft used in the program were two Navajos, one pressurized for cloud seeding, and an Aztec. Silver iodide flares were used for all cloud seeding. Other information given includes an equipment status report and rawisonde and precipitation tables. (Seigler-IPA)
W80-03320

LAND-USE AND UPLAND WATER RESOURCES IN BRITAIN--A STRATEGIC LOOK,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W80-03363

PROBLEMS IN WEIGHTING OF HYETOGRAPHS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
G. Aron, J. G. Collins, and D. F. Kibler.
Water Resources Bulletin, Vol 15, No 6, p 1556-1564, December 1979. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Hyetographs, *Isohyets, *Storms, Precipitation(Atmospheric), Weight, Rain gages, Watersheds(Basins), Floods, Rain, Flood flow, *Storm runoff modeling, *Hyetograph weighting, Storm patterns, Rainfall volumes, Precipitation measurement, Thiesson diagram, Isohyetal maps.

The conventional weighting factor application to hyetograph ordinates resulted in artificially attenuated storm patterns. A modified weighting procedure was suggested that allows adjustments in the storm timing, peak intensity, and volume but conserves the storm pattern observed at the rain gage nearest to the watershed point of interest. The systematic underestimation of peak flood flows, which resulted from conventional hyetograph weighting, was avoided by conserving the hyetograph shape from the rain gage nearest to any subarea of a modeled watershed and by merely applying weighting factors to the rainfall volumes and temporal center of gravity of several hyetographs. (Roberts-ISWS)
W80-03365

DETERMINING OVERWATER PRECIPITATION FROM OVERLAND DATA: THE METHODOLOGICAL CONTROVERSY ANALYZED,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. J. Bolsenga.
Journal of Great Lakes Research Vol 5, No 3-4, p 301-311, 1979. 3 Fig, 6 Tab, 27 Ref.

Descriptors: *Great Lakes, *Precipitation gages, *Precipitation atmospheric, Snowfall, Rainfall, Limnology, Radar, Remote sensing, Weather patterns, Instrumentation, Towers, Islands, Water levels, Hydrographs, Lakes.

Various methods for measuring or estimating overwater precipitation are examined to determine the usefullness and accuracy of the techniques used. Knowledge of the relationship of land precipitation to lake precipitation is critical in determining overwater precipitation since actual gage measurements of lake precipitation are practically nonexistent. In the past overwater precipitation for large lakes has been estimated by measuring precipitation with gages on islands, towers, or other on lake structures. These measurements are then compared to shoreline measurements and lake/land precipitation ratios are calculated. The ratios are then used to estimate lake precipitation from shore precipitation measurements. However, the validity of such results are now being questioned due to seasonal land lake/land precipitation ratio changes and precipitation gage inaccuracies. Gage inaccuracies or undercatchments result from shielded or unshielded conditions, wind velocity and direction, and differing precipitation forms such as rain, snow, or sleet. Recent tests with accurate gage measurements however, show that lake/land differences are small and monthly differences are statistically insignificant. One solution to gage accuracy problems is the use of radar to measure overwater precipitation. In tests, ratios obtained with radar agree well with actual field data. Suggestions are given for designing a viable accurate method of overwater precipitation determination by initially using radar to determine precipitation ratios. Revised ratios may be needed seasonally or as any change occurs which would alter ratio values. (Seigler-IPA)

Field 2—WATER CYCLE

Group 2B—Precipitation

W80-03392

METEOROLOGICAL ASPECTS OF THE 1975-76 DROUGHT,
For primary bibliographic entry see Field 2E.
W80-03445

THE APPLICATION OF HYDROLOGIC MODELS TO SMALL WATERSHEDS HAVING MILD TOPOGRAPHY,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
E. C. Dickey, J. K. Mitchell, and J. N. Scarborough.
Water Resources Bulletin, Vol 15, No 6, p 1753-1769, December 1979. 5 Fig, 5 Tab, 12 Ref.

Descriptors: *Model studies, *Hydrograph analysis, *Illinois, *Small watersheds, Watersheds(Basins), Hydrology, Simulation analysis, Topography, Shape, Rainfall, Storms, *Hydrologic modeling, SCS model, Hydrograph simulation, Mild topography, Rainfall events, Time rate distribution, Empirical relationships.

This paper evaluated the applicability of hydrologic models described by L.F. Huggins and the Soil Conservation Service to small watersheds by comparing the simulated and actual hydrograph for both gaged and ungaged situations. The annual maximum rainfall events plus storms exceeding 2.5 inches from 25 years of rainfall and runoff data for two small watersheds were selected for the model evaluations. Simulated and actual hydrographs were compared using a parameter that contained volume, peak, and shape factors. One-half of the selected storms were used to calibrate the models. For both models, there were no significant differences between the simulated and actual runoff volumes and peak runoff rates. Parameters obtained during the calibration process and relationships developed to estimate antecedent moisture and to modify tabulated runoff curve numbers were used to simulate the runoff hydrograph from the remaining storms. These remaining storms or test storms were simulated only once in order to imitate an ungaged situation. In general, both the Huggins and Soil Conservation Service models performed similarly on the test storms, but the level of model performance was lower than that for the calibration storms. (Roberts-ISWS)
W80-03469

A HYDROLOGICAL ANALYSIS OF EAST AUSTRALIAN FLOODS USING NIMBUS-5 ELECTRICALLY SCANNING RADIOMETER DATA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W80-03474

RECORD TORRENTIAL RAINSTORMS ON THE ISLAND OF HAWAII, JANUARY-FEBRUARY 1979,
Mauna Loa Observatory, Hilo, HI.
R. S. Cram, and H. R. Tatum.
Monthly Weather Review, Vol 107, No 12, p 1653-1662, December 1979. 5 Fig, 4 Tab, 8 Ref.

Descriptors: *Rainfall, *Excessive precipitation, *Precipitation(Atmospheric), *Hawaii, Floods, Flash floods, Storms, Tropical regions, Islands, Precipitation intensity, Weather, Climatology, Meteorology, Torrential rainstorms.

The heaviest and most extensive rainstorms in the history of weather records on the island of Hawaii occurred during the first two months of 1979. Nearly every rainfall record kept by the National Weather Service from the 45 min total through the monthly and two monthly totals was exceeded during January and February 1979. Only twice in the 90-year history of weather records at Hilo have rainfalls of similar magnitude occurred. The most significant characteristic of the 1979 storms is that the record rainfall was produced from warm clouds; clouds whose temperature is everywhere greater than 0C. The February 1979 storm produced rainfalls of 78.2 mm in 1 h and 566.4 mm in 24 h at Hilo from storm clouds with tops below the freezing level. Such rainfall amounts and rates are customarily believed to occur only during thunderstorms, where the cloud tops extend considerably above the freezing level. Thunderstorm activity was absent during the 1979 rainstorms. An account of the January and February 1979 storms and a survey of past record rainfalls on the island of Hawaii were presented. (Sims-ISWS)
W80-03475

A DISTANT READING RAINGAUGE,
Meteorological Office, Poona (India). Instruments Div.
For primary bibliographic entry see Field 7B.
W80-03476

VERY LARGE FLOODS IN THE BRAHMAPUTRA RIVER IN AUGUST 1962, PART I: SYNOPTIC ASPECTS,
Observatory, New Delhi (India).
C. Ramaswamy, and V. S. Rao.
Mausam, Vol 30, No 1, p 9-20, January 1979. 10 Fig, 3 Tab, 10 Ref.

Descriptors: *Floods, *Rainfall, *Monsoons, *Rivers, Precipitation(Atmospheric), Excessive precipitation, Precipitation excess, Runoff, Watersheds(Basins), Winds, Air circulation, Weather, Meteorology, *India, *Brahmaputra River(India).

The large scale synoptic situations from the time of onset of the southwest monsoon to the end of August in 1962 over the catchment of the Brahmaputra (including that of the Tsangpo) were studied using the synoptic charts prepared in India and those published by the Japan Meteorological Agency. Time-sections of the upper winds over Gauhati (26 deg 11 min N, 91 deg 45 min E) and of the heavy rainfall at the India Meteorological Department stations over the Brahmaputra basin were also studied for all important situations. It was shown that the lee-vortices which develop to the southeast of the Tibetan plateau play a very important role in the occurrence of very heavy rainfall over and near Pasighat (28 deg 06 min N, 95 deg 23 min E) in the extreme northeast of Arunachal Pradesh and over the eastern half of the Tsangpo. The conclusion was drawn that frequent and exceptionally heavy rainfall over these areas was predominantly responsible for the phenomenal discharge of the Brahmaputra at Pandu near Gauhati on 24 August 1962. The genesis of the lee-vortices to the southeast of the Tibetan plateau was also discussed. The need for the development of synoptic climatology of the above-mentioned area, with special reference to weather over the Brahmaputra basin, was pointed out. (Sims-ISWS)
W80-03598

2C. Snow, Ice, and Frost

ICE THICKNESS INDICATOR,
D. W. Iwanicki.
US Patent No 4,175,512, 7 p, 8 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 868, November 27, 1979.

Descriptors: *Patents, *Ice, *Water types, Ice cover, Safety, Measurement, Iced lakes, Equipment, Ice thickness.

An ice thickness indicator is placed at the surface of a body of water by floats. It provides a means to indicate whether the water has frozen to a predetermined thickness. The device includes an enclosed chamber which may be filled with water. The chamber is expansible by means of a movable member which partly defines the chamber. The movable member is located below the surface of the water and is connected to an upwardly extending indicator which displays different indications, depending on the relative position of the movable member. As the body of water in which the device is immersed freezes, the water within the expansible chamber also freezes and expands to cause movement of the movable member and operate the indicator. (Sinha-OEIS)
W80-03513

2D. Evaporation and Transpiration

AN IMPROVED WEIGHING LYSIMETER FACILITY FOR CITRUS EVAPOTRANSPIRATION STUDIES,
Soil and Irrigation Research Inst., Pretoria (South Africa).
G. C. Green, and W. Bruwer.
Water SA, Vol 5, No 4, p 189-195, October 1979. 6 Fig, 7 Ref.

Descriptors: *Lysimeters, *Evapotranspiration, *Citrus fruits, *Water requirements, Moisture uptake, Water utilization, Transpiration, Climatology, Evaporation, Photosynthesis, Soil water movement, Water loss, Diurnal, Orchards, Plant groupings, South Africa.

Three prototype lysimeters installed in a block of Valencia trees, planted in 1963, were used to make detailed and consistent evapotranspiration (ET) measurements for the study of seasonal and daily citrus water relations. All lysimeters contained a single tree for a total mass of approximately 50 tons. The first lysimeter (C) was installed in 1970 and the other two (A and B) were installed in 1972. The steel lysimeter tanks for A and B were contained in concrete-lined pits. To prevent rusting the inner tank surfaces were coated with fiberglass. Some deficiencies in the tank construction were noted such as tank wall bulges. In 1975 an improved measuring system was installed and all three lysimeters were equipped with commercially obtainable precision load cells with a nominal accuracy of 0.02%. Three separate calibration runs were made with one run producing test masses of undisputed accuracy. The lysimeters surpassed general performance expectations with a sensitivity resolution of 2 kg the equivalent of 0.15mm of water over the 13.4 sq m surface area. The lysimeters also showed a good degree of uniformity in ET response. Daily ET totals can be measured within a 10% accuracy in winter and a 3% accuracy in summer. These accurate direct measurements of diurnal transpiration can be used to model the mechanism of water uptake and flow in citrus trees given the high transpiration rates of summer. (Seigler-IPA)
W80-03325

PHREATOPHYTE EVAPOTRANSPIRATION AND ITS POTENTIAL REDUCTION WITHOUT ERADICATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. C. Davenport, J. E. Anderson, L. W. Gay, B. E. Kynard, and E. K. Bonde.
Water Resources Bulletin, Vol 15, No 5, p 1293-1300, October 1979. 21 Ref. OWRT-C-6030 (5235)(5).

Descriptors: *Antitranspirants, *Evapotranspiration, *Phreatophytes, Groundwater, Water conservation, Wildlife habitats, Energy budget, Tamarisk, Lysimeters, Stomata, Riparian water loss, Balance of nature, *Chemical eradication, Bowen ratio, Foliage, Spray adherence, Nontoxic antitranspirant, Potential eradication, Riparian phreatophytic vegetation.

The continuous availability of groundwater to riparian phreatophytic vegetation results in large evapotranspiration losses in summer. Chemical or physical eradication of this vegetation has undesirable environmental effects. Spraying phreatophyte foliage with a nontoxic antitranspirant may reduce transpiration without eradication. Transpiration rate per unit leaf area is similar for several phreatophyte species, but evapotranspiration per unit land area of phreatophytes depends more on stand density than species. The mean for saltcedar evapotranspiration in June was 8.1 mm/day measured by Bowen ratio, compared with 7.9 mm by lysimeters. Growth-retardants reduced transpiration by over 50% in laboratory tests where foliage was thoroughly sprayed. In the field, antitranspirant sprayed by a back-pack mistblower reduced evapotranspiration by 20-35% initially and by 10% after

one month. High cost and spraying difficulties precluded use in 1979. (Roberts-ISWS)
W80-03442

AN ELECTRICAL CONDUCTANCE METHOD FOR DETERMINING CONDENSATION AND EVAPORATION PROCESSES IN ARID SOILS WITH HIGH SPATIAL RESOLUTION,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hanover (Germany, F. R.). Inst Fuer Strahlenbotanik.
C. Bunnenberg, and W. Kuhn.
Soil Science, Vol 129, No 1, p 58-66, January 1980. 8 Fig, 21 Ref.

Descriptors: *Electrical conductance, *Condensation, *Evaporation, *Arid climates, Soil moisture, Laboratory tests, Moisture content, Instrumentation, Soil density, Soil temperature, Dew, Spatial resolution.

This paper described a new instrument developed to measure moisture movements as a result of condensation and evaporation processes in the upper soil layers in laboratory and field experiments. It is based on the well-known method of relating the moisture content of a soil to its electrical conductance. The high spatial resolution of 2 millimeters and the high sensitivity, especially in the dry range, make it a valuable tool for condensation and evaporation studies during the dry season of arid and semi-arid climates, as well as for soil physical investigations of water vapor diffusion. A number of laboratory tests demonstrate the performance of the instrument. (Visocky-ISWS)
W80-03470

EVAPOTRANSPIRATION FROM AN ARID ZONE PLANT COMMUNITY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
T. W. Sammis, and L. W. Gay.
Journal of Arid Environments, Vol 2, No 4, p 313-321, Dec 1979. 5 Fig, 15 Ref.

Descriptors: *Evapotranspiration, *Water loss, *Desert plants, *Creosotebush, *Model studies, *Desert plants, Plant communities, Lysimeters, Soil-water-plant relationships, Water budget, Southwest U.S.

Total water loss was measured in two ways in a creosotebush community near Tucson, Arizona, with the specific objectives of: (1) measuring evapotranspiration from a typical stand, (2) evaluating the relative importance of the transpiration and evaporation components, and (3) testing and refining a simple diffusion model for estimating transpiration. Primary measurements made through the entire year with a weighing lysimeter at the US/IBP Desert Biome Silverbell Validation Site near Tucson, were used in the water budget method to evaluate evaporation from bare soil plots, and evapotranspiration from a crosotebush community. Additional measurements were made of soil, plant, and climatological data needed to model the transpiration rate from the lysimeter plant and from the surrounding stand. Water losses were found to closely approximate measured precipitation over the year long period, with total losses being 259 mm from the lysimeter, 242 mm from the adjacent bare plots. Transpiration losses estimated from water budgets of bare and vegetated plots were in reasonable agreement with estimates obtained from a simple canopy diffusion model. It was concluded that transpiration losses were a small portion of the total ET due to the high resistence and small leaf area index of the creosotebush canopy, and attemps to control ET by controlling creosotebush or similar desert vegetation will be ineffective. (Tickes-Arizona)
W80-03548

2E. Streamflow and Runoff

FLOOD HAZARD STUDY, LITTLE CALFPASTURE RIVER -- GRASSY RUN, AUGUSTA COUNTY, VIRGINIA.
Soil Conservation Service, Washington, DC.
Prepared in cooperation with the Virginia State Water Control Board, Headwaters Soil and Water Conservation District; and the Augusta County Board of Supervisors, June 1979. 51 p, 17 Fig, 3 Tab, 11 Ref, 1 Append.

Descriptors: *Virginia, *Flood plains, *Flood damage, *Historic floods, Flood forecasting, Hydrology, Flood plain zoning, Flood protection, Tropical cyclones, Thunderstorms, Runoff, Watershed management, Appalachian Mountain Region, Precipitation(Atmospheric), Precipitation excess, Little Calfpasture River.

The flood plain for the Little Calfpasture River and selected tributaries is defined and potential flood losses are identified. The drainage area for the River is 54.8 square miles and is part of the Maury River Subbasin of the James River in the Southern Appalachian Ridges and Valleys physiographic province. Normal annual precipitation is approximately 40 inches of which 19 inches is snowfall. About 80% of the drainage area is forested, about 12% cultivated, and the remaining 8% is comprised of towns and other miscellaneous uses. The flood plain itself has many residences and commercial structures built along the Chesapeake and Ohio Railroad and State Route 42. The flood plain is about 40% cropland; 30% idle brush and woods; 16% pasture; and 14% homes, commercial buildings, and other construction. Several tributaries and Grassy Run were included in the study. In the past tropical storms have caused major floods in the area with the largest reported in June 1949 although no gage records are available. It is estimated to be an 80-year flood which inundated 320 acres of crops and damaged about 30 homes. Due to the steepness of the area excess rainfall concentrates quickly, floods rapidly, and recedes rapidly. With present conditions an extreme flood would inundate about 360 acres with approximately 2 feet of water moving at about 3 feet/second. Sixty-nine buildings on the flood plain have the primary potential for damage. Recommendations are made for the development and implementation of a comprehensive flood plain management program. (Seigler-IPA)
W80-03314

DETERMINING PEAK-DISCHARGE FREQUENCIES IN AN URBANIZING WATERSHED--A CASE STUDY,
Corps of Engineers, Detroit, MI. Detroit District.
For primary bibliographic entry see Field 2A.
W80-03349

FLOOD HYDROGRAPH AND PEAK FLOW FREQUENCY ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2A.
W80-03350

TESTING OF SEVERAL RUNOFF MODELS ON AN URBAN WATERSHED,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2A.
W80-03352

SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-03353

THE RELATIONSHIP BETWEEN THE TIME BASES OF SIMULATION MODELS AND THEIR STRUCTURE,
Technion-Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
M. H. Diskin, and E. Simon.
Water Resources Bulletin, Vol 15, No 6, p 1716-1732, December 1979. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Mathematical models, *Simulation analysis, *Hydrology, *Runoff, Model studies, Analytical techniques, Watersheds(Basins), Semiarid climates, Flow, Annual, Synthetic hydrology, Time base, Optimal parameters.

The time base of a simulation model can be defined as a combination of two time intervals. One is the interval used for input and internal computations. The second is the interval used for the output and calibration of the model. The time base of a model is related, on the one hand, to the type of applications for which the simulated data are used, and on the other hand, to the structure and complexity of the model. The latter may be represented by the number of parameters employed to specify the operation of the model. Using data typical to relatively small watersheds in a semiarid climate, the authors studied the interaction between the complexity of a series of models and the time bases used by them. This included the effects of the two factors, time base and complexity, on the values of the optimal parameters, prediction of mean annual flow, and general performance of the models. The main conclusion was that if the acceptable time base is longer, the model can be less complex needing fewer parameters. There is also an advantage in using a time base comprising a shorter input time interval and a longer output time interval. (Sims-ISWS)
W80-03359

PROBLEMS IN WEIGHTING OF HYETOGRAPHS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W80-03365

A HYDRAULIC TRANSIENT MODEL OF THE UPPER ST. LAWRENCE RIVER FOR WATER RESOURCES STUDIES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
A. J. Potok, and F. H. Quinn.
Water Resources Bulletin, Vol 15, No 6, p 1538-1555, December 1979. 8 Fig, 4 Tab, 10 Ref.

Descriptors: *St. Lawrence River, *Lake Ontario, *Great Lakes, *Model studies, Mathematical models, Rivers, St. Lawrence Seaway, Water levels, Flow, River flow, Roughness(Hydraulic), Roughness coefficient, Ice cover, Hydrographs, Theoretical analysis, Hydraulics, Hydrology, Water resources, Water management(Applied), Manning's coefficient.

A one-dimensional hydraulic transient model has been designed for water resource studies of Lake Ontario and the Upper St. Lawrence River. The model simulates water surface profiles and flows in the St. Lawrence River between Lake Ontario and the Moses-Saunders Power Dam under both open water and ice-covered conditions. Errors in water surface elevations were found to be less than 0.2 feet during quasi-steady conditions on the river. Comparable errors occurred during the ice-covered conditions. A sensitivity analysis found the model to be most sensitive to the roughness coefficients and the flow through the power dam. (Sims-ISWS)
W80-03366

PRESENTATION OF LONGITUDINAL DISPERSION DATA,
Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
P. C. Chatwin.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15150, p 71-83, January 1980. 3 Fig, 1 Tab, 25 Ref, 3 Append.

Descriptors: *Dispersion, *Flow, *Model studies, Rivers, Turbulence, Data collections, Estuaries, Hydrology, Water pollution, Equations, Numerical analysis, Analytical techniques, Statistical methods, *Longitudinal dispersion, Edgeworth series, Skewness, Kurtosis, Data analysis.

It was proposed that deviations from Gaussianity of observed profiles of the concentration of a solute in a cloud as it passes the measuring station in a river, estuary, or similar flow should be explicitly measured by recording the nondimensional

skewness and kurtosis. Examples of applications of the proposal were examined. It was shown that observed profiles can be fitted well by Edgeworth series provided the skewness and kurtosis are not too large. Review of the way in which different causes of deviations from Gaussianity can be classified in terms of the evolution of the skewness and kurtosis with downstream position was given, and it was argued that this is the most important point of the proposal. (Lee-ISWS)
W80-03379

SCIENTIFIC ASPECTS OF THE 1975-76 DROUGHT IN ENGLAND AND WALES,
Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. The Royal Society, London, England, 1978. 133 p.

Descriptors: *Droughts, *Watersheds(Basins), *Conferences, *Hydrology, Demonstration watersheds, Water balance, Agriculture, Groundwater, Aquifers, River systems, Surface waters, Planning, Groundwater resources, Meteorology, Evaporation, Rainfall, Soil moisture, Analytical techniques, Analysis, Crop response, Livestock, Foreign research, Reservoirs, Water quality, Water supply, Moisture deficit, Low flow, Low-flow frequency, Frequency, Water pollution, *England, *Wales.

The drought of 1975-76 was a rare event: the Royal Society discussion meeting about it was unique. The discussion, which is recorded in this volume, was made possible by the great expansion of hydrology in Britain during the past three decades, and the contributors, who had taken part in this expansion, came from government departments, research council institutes, and university departments. Here are the facts about the drought, partly within the historical sequence of such events, and partly in the context of what happened to Britain's near neighbors and of weather elsewhere in the Northern Hemisphere. The wide range of effects is shown in the impact the drought had on experimental catchments; on farming, including crops and stock, pests and diseases; on river behavior and the loads imposed on water resources--surface and underground--and the devices, used or planned, to deal with shortages; and on sewage disposal and other pollution problems. A forward look considers what summer 1976 has to teach in the planning of future development of Britain's water resources. (See also W79-06807 and W80-03445 thru W80-03450) (Humphreys-ISWS)
W80-03444

METEOROLOGICAL ASPECTS OF THE 1975-76 DROUGHT,
R. A. S. Ratcliffe.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977, p 3-20, 1978. 13 Fig, 17 Ref.

Descriptors: *Droughts, *Hydrology, *Climatology, *Model studies, Rainfall, Evaporation, Weather, Analysis, Analytical techniques, Meteorology, Moisture deficit, Weather data, Foreign research, Air circulation, Atmospheric pressure, *England, *Wales, Isopleths, Global aspects.

The broad scale meteorological features were examined, and it was shown that the drought was related to a variety of factors, including unusual coldness in the North Pacific Ocean and over Canada in the winter half-year, upper winds stronger than usual in the Central Pacific, and the quasi-biennial oscillation. Feedback mechanisms involving Atlantic sea temperatures and the drought itself helped to maintain the atmospheric mode. The additional evaporation from a reservoir in southern England due to extra sunshine, high summer temperature, etc., was estimated. An attempt was made to put the drought into historical perspective, with the conclusion that it appears to be a rare event rather than a symptom of climatic change. Lastly, by using a Meteorological Office general circulation numerical model, it was shown that a large area of dry ground may inhibit rainfall: the dryness of the ground over Western Europe in the 1976 summer may have had this effect. (See also W80-03444) (Humphreys-ISWS)
W80-03445

SOME DETAILED WATER BALANCE STUDIES OF RESEARCH CATCHMENTS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W80-03446

THE EFFECT OF THE DROUGHT ON BRITISH AGRICULTURE,
National Agricultural Advisory Service, London (England).
E. S. Carter.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. p 43-54, 1978. 8 Tab.

Descriptors: *Droughts, *Agriculture, *Crop production, *Crop response, Foreign research, Farm management, Productivity, Cereal crops, Horticultural crops, Grasslands, Livestock, Wheat, Barley, Oats, Viruses, Potatoes, Sugar beets, Poultry, Milk, *England, *Wales.

The drought was most severe in the south of the country, but had serious effects in all areas. The dry summer of 1975 followed by an unusually dry winter resulted in the majority of the country having a soil moisture deficit in May 1976. Crop production was affected both directly and indirectly through the buildup of certain pests and diseases favored by the weather. Grassland production was severely restricted, and some young leys killed out. Livestock remained remarkably fit, but milk yields fell and lambs and grazing cattle took longer to fatten. Supplementary feeding of hay, straw, and concentrates was necessary. Some cases of poisoning resulted from stock foraging for food where pasture was bare, and poor quality water supplies caused problems. There were losses of sheep, pigs, and calves due to high temperatures. Longer term effects of the drought include an enhanced persistence of soil-acting herbicides and residues. There was a remarkably quick recovery when the rains came. Pastures greened up rapidly and seeds sown under dry conditions germinated giving quite reasonable forage and other crops. The Meteorological Office claim that such a season was one in 500 years. (See also W80-03444) (Humphreys-ISWS)
W80-03447

THE EFFECTS OF DROUGHT ON THE RIVER SYSTEMS,
Birmingham Univ. (England). Dept. of Water Engineering.
For primary bibliographic entry see Field 2A.
W80-03448

POLLUTION PROBLEMS ARISING FROM THE 1975-76 DROUGHT,
Anglian Water Authority, Huntingdon (England).
A. W. Davies.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. p 97-107, 1978.

Descriptors: *Droughts, *Water pollution, *Rivers, *Groundwater, Surface waters, Sewerage, Sewage treatment, Water quality, Water supply, Bacteria, Algae, Low flow, Fisheries, Nitrates, *England, *Wales.

The paper considered the gradual transition from the 'normal' quality state of surface waters and groundwaters, and discussed the rapid change in the quality of these waters with the onset of heavy rain towards the end of August 1976. By the end of March 1977 the principal effects of the drought on river water quality had passed, and conditions were close to 'normal' for that time of year. The long term effects of using poor quality water to fill water supply reservoirs cannot be predicted accurately, but it is expected that these waters will present greater treatment difficulties in meeting water supply quality criteria in the future. The effect on groundwater quality may not become apparent for some time. This is particularly so for water abstracted from chalk. The nitrate levels in limestone and gravel waters appear, at the time of writing (September 1977), to have reached the maximum and be decreasing, although some upturn is to be expected on the recharge of these aquifers during the forthcoming winter. It appears unlikely that the problems experienced during the postdrought period will recur unless a very dry summer is followed by an equally wet winter. The effect of the drought on the nitrate levels, particularly in groundwater, was to enhance the upward trend, which evidence available suggests commenced in the early 1950s. In retrospect, had not the drought been followed by very heavy rain, the problems of postdrought quality would have been more severe. The largest single factor which reduced the impact of postdrought pollution was dilution. (See also W80-03444) (Humphreys-ISWS)
W80-03449

PLANNING FOR DEVELOPMENT OF GROUNDWATER AND SURFACE WATER RESOURCES,
Central Water Planning Unit, Reading (England).
O. Gibb, and H. J. Richards.
In: Scientific Aspects of the 1975-76 Drought in England and Wales; Proceedings of a Royal Society Discussion Meeting held on October 28, 1977. p 109-130, 1978. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Planning, *Droughts, *Water resources development, *Long-term planning, Surface waters, Groundwater resources, Water resources, Foreign research, Aquifers, Rainfall, Streamflow, Data collections, Hydrographs, Water quality, *England, *Wales, Water authorities.

The assessment and development of water resources were considered in relation to present demands and the developed and potential water resources of England and Wales. Normal seasonal changes in storage were compared with those of 1975-76 and conditions during this period compared with previous droughts. There is no basic shortage of water and the extent of restrictions which may have to be applied during drought events is largely determined by the price the consumer is prepared to pay for the safeguard of additional capacity and assured supply. Future trends in water resource planning were summarized as follows: (1) Increasing attention to studies of water use and control of waste with a view to more efficient water use and better forecasts of demand. Control of demand by more effective water-using appliances and the possibility of control by pricing. (2) More detailed hydrological assessments and the design of operating rules with particular attention to the benefits that may be derived from the combined use of different sources. (3) Increasing attention to environmental, amenity, and recreational aspects of water resource developments. (4) More detailed studies of appropriate reliability standards and their implications for the consumer. (5) Increasing attention to quality problems, in particular those associated with reuse of river water containing sewage and industrial effluents. Of these, combined use, reliability, and the quality problems of river-derived supplies were highlighted rather than identified by the 1975-76 drought. (See also W80-03444) (Humphreys-ISWS)
W80-03450

AGGRADATION IN STREAMS DUE TO OVERLOADING,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-03452

FLOW PAST FENCE IN TURBULENT BOUNDARY LAYER,
Roorkee Univ. (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-03454

A SYSTEMS MODEL OF STREAM FLOW AND WATER QUALITY IN THE BEDFORD-OUSE RIVER--1. STREAM FLOW MODELLING,

Institute of Hydrology, Wallingford (England).
P. Whitehead, P. Young, and G. Hornberger.
Water Research, Vol 13, No 12, p 1155-1169, 1979. 12 Fig, 1 Tab, 39 Ref.

Descriptors: *Streamflow, *Rainfall-runoff relationships, *Rivers, *Model studies, Mathematical models, Flow, River flow, Time series analysis, Analytical techniques, Rainfall, Precipitation(Atmospheric), Runoff, Hydrographs, Forecasting, Hydrology, *England, *Bedford-Ouse River(England).

This paper, the first of a two part description of the modeling activities associated with the Bedford-Ouse River Study, concentrated on streamflow characterization. The streamflow models are of a stochastic-dynamic type in which a simple lumped parameter differential equation model for mainstream flow is enhanced by stochastic time-series descriptions of rainfall-runoff behavior. The models have been developed using a new systematic approach to the modeling of badly defined dynamic systems which is centered around the exploitation of recursive methods of parameter estimation and time-series analysis. At the same time, the models have quite strong links with more conventional models used previously in hydrological systems analysis, and the implications of the modeling results can easily be interpreted in conventional hydrologic terms. An important aspect of the modeling exercises described in the paper was that they are objective orientated and, in the Bedford-Ouse Study, the models were developed specifically with operational control and management applications in mind. (Sims-ISWS)
W80-03456

A HYDROLOGICAL ANALYSIS OF EAST AUSTRALIAN FLOODS USING NIMBUS-5 ELECTRICALLY SCANNING RADIOMETER DATA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W80-03474

A DISTANT READING RAINGAUGE,
Meteorological Office, Poona (India). Instruments Div.
For primary bibliographic entry see Field 7B.
W80-03476

FLOODFLOW CHARACTERISTICS OF BUTTERNUT CREEK AND JAMESVILLE RESERVOIR, JAMESVILLE, ONONDAGA COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
B. Dunn.
Available from: OFSS U.S. Geological Survey Box 25425, Federal Center Denver, CO microfiche $3.50 paper copy $2.00. Geological Survey open-file report 79-1292, September 1979. 14 p, 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Flood, *Flow characteristics, *Model studies, *Maximum probable flood, *Design flood, Unit hydrographs, Discharge(Water), Dams, Peak discharge, Gaging stations, New York, *Onondaga County(NY), *Butternut Creek(NY), *Jamesville Reservoir(NY), U.S. Army Corps of Engineers, HEC-1 program, Log-Pearson type III analysis.

A hydrologic study of Butternut Creek, near Jamesville, Onondaga County, N.Y., was done to develop inflow and outflow hydrographs of the 'probable maximum flood' and the 'standard project flood' of Jamesville Reservoir, as defined by the U.S. Army Corps of Engineers. The inflow and outflow discharges of the probable maximum flood were computed to be 23,600 and 23,100 cubic feet per second, respectively, and of the standard project flood, 9,400 and 8,800 cubic feet per second, respectively. A rating curve computed for the dam spillway indicates that water-surface elevations produced at the dam by runoff from both the standard project flood and the maximum probable flood would be above the top of the spillway abutments. The 10- and 100-year peak discharges at the Butternut Creek gaging station were computed by the HEC-1 program of the Corps of Engineers to be 2,160 and 3,450 cubic feet, respectively, as compared to 1,680 and 2,810 cubic feet per second computed by a log-Pearson type III analysis of the station data. The HEC-1 values are within the 5- and 95-percent confidence limits of the log-Pearson type III values. (Kosco-USGS)
W80-03488

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE. PART B: CALIFORNIA, CASE STUDIES,
Jones and Stokes, Inc., Sacramento, CA.
For primary bibliographic entry see Field 6G.
W80-03517

TYPE 16 FLOOD INSURANCE STUDY: TSUNAMI PREDICTIONS FOR THE WEST COAST OF THE CONTINENTAL UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. R. Houston, and A. W. Garcia.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 663, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-78-26, December 1978. 69 p, 30 Pl, 32 Ref, 1 Append.

Descriptors: *Tsunamis, *Mathematical models, Ocean waves, Coastal flooding, Earthquakes, Pacific Ocean, *Flood insurance, *West coast states, Wave runup.

Calculations of runup due to tsunamis of distant origin were made for most of the west coast of the continental United States. Runup values were determined that were expected to be equaled or exceeded on the average of once per 100 or once per 500 years. Historical data of tsunami activity in distant generation regions were used in the investigation in conjunction with numerical models that generated tsunamis and propagated them across the deep-ocean and nearshore region. The combined effects of astronomical tides and tsunamis were also incorporated into the analysis. Numerical simulations of actual historical tsunamis and comparisons of calculations with tide gage recordings were presented. Calculations of tsunami runup based upon data of local historical tsunamis (at the few locations on the west coast where there was sufficient historical data to allow reasonable predictions) were compared with predictions based upon the methods presented in the investigation. (WES)
W80-03556

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIV-APPENDIX M, FLOOD CONTROL.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 281, Price codes: A11 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee, December 1967. 227 p, 38 Fig, 88 Tab, 25 Photographs.

Descriptors: *Water resources development, *Ohio River Basin, *Multiple purpose projects, *Flood control, *Regional development, *Flood damage, *Flood protection, Flooding, Rivers, Control structures, Reservoirs, Non-structural alternatives, Land use, Planning, Flood plain management, Administration, Resources development, Natural resources, Water policy, Water resources, Peak discharge.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to determine the need for further flood control measures and to enhance the economic well being of the Basin. This Appendix discusses present basin flooding problems and future potential problems. Flooding in the Basin is a serious problem and, in spite of a major flood control program, the problems continue to grow. The study area covers 163,000 square miles and has a population of 20 million persons. Current flood control measures include reservoirs, local protection projects, and non-structural measures. Potential solutions to the flood problem include additional development of control and prevention programs in all major sub-basins; more multipurpose reservoirs in sub-area basins; and better upstream land management and treatment which could reduce as much as 10% of flood damages. A potential future flood plan would include both additional upstream and downstream Federal control projects; non-structural measures such as land use regulation; and flood plain studies to identify the magnitude of the flood problem in the Basin. Flood problems and potential solutions are discussed for each of the 19 Ohio River sub-areas and the main stream. The methodology employed in the flood damage studies, the inventories used, and the procedures employed for determining and projecting upstream flood damages are presented. (Arnold-NC)
W80-03569

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME IV-APPENDIX C, HYDROLOGY.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 272, Price codes: A09 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee, August 1966. 197 p, 10 Fig, 32 Tab, 40 Plates, 34 Ref.

Descriptors: *Water resources development, *Ohio River Basin, *Hydrologic studies, *Flood control, *Hydrologic data, *Runoff, *Streamflow, *Multiple purpose projects, *Standard Project Flood, *Floods, *Hydrology, Ice jams, Flood protection, Historic floods, Reservoirs, Flood stages, Flood forecasting, Droughts, Low flow, Sedimentation, Precipitation, Climatology, Meteorology, Watershed(Basins), Control structures.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly for that part within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix contains climatologic and hydrologic data for the analysis of water and related land resource problems in the Basin and formulation of a comprehensive framework plan for their solution. The data presented provide a basis for discussion of water problems and solutions contained in other appendices. Data are presented on precipitation and streamflow, magnitudes and frequency of floods and frequency of low flows. Availability of surface water is also estimated. Topography in the Basin is varied from flat and rolling plains to mountains. All major rivers in the Basin have dam and lock systems. Precipitation is distributed throughout the year, although severe droughts have occurred. The flood season is from December through April, with major recent floods occurring in 1963 and 1964. The worst flood occurred in 1937, equalling the Standard Project Flood (SPF) in duration and discharge levels. By 1964 38 reservoirs for flood control had been completed, with 9 others under construction and engineering studies being made for an additional 6. Profiles are presented for the SPF. Flood data are presented for the Basin. (Arnold-NC)
W80-03578

AN URBAN RUNOFF MODEL FOR TULSA, OKLAHOMA,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 6A.
W80-03582

THE DEVELOPMENT AND SERVICING OF SPATIAL DATA MANAGEMENT TECHNIQUES IN THE CORPS OF ENGINEERS,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.

For primary bibliographic entry see Field 6A.
W80-03588

FLOOD DAMAGE ASSESSMENTS USING SPATIAL DATA MANAGEMENT TECHNIQUES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 6A.
W80-03589

SPATIAL DATA ANALYSIS OF NONSTRUCTURAL MEASURES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 6A.
W80-03590

VERY LARGE FLOODS IN THE BRAHMAPUTRA RIVER IN AUGUST 1962, PART I: SYNOPTIC ASPECTS,
Observatory, New Delhi (India).
For primary bibliographic entry see Field 2B.
W80-03598

2F. Groundwater

IDENTIFICATION OF AQUIFER PARAMETERS USING NUMERICAL TECHNIQUES,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. Neuman, and S. Yakowitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143696, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona Project Completion Report (1979), 16 p, 15 Ref, OWRT B-051-ARIZ (3), 14-34-0001-7135.

Descriptors: Groundwater, *Mathematical models, *Aquifer characteristics, Hydrogeology, *Transmissivity, Regression analysis, Numerical analysis, *Water level fluctuations, Arizona, Parameter identification, Numerical methods, Cortaro basin(Ariz).

A new statistically based approach to the problem of estimating spatially varying aquifer transmissivities on the basis of steady state water level and flux data has been developed. The method involves solving either one, or a series of, generalized nonlinear regression problems. When there is a need to solve a series of such problems, the method requires selecting one particular solution from this series by means of a comparative analysis of residuals. A linearlized error analysis of the solution is included. this analysis allows one to estimate the covariance of the transmissivity estimates as well as the square error of the estimates of hydraulic head. In addition to the explicitly statistical orientation of the method, it has an additional feature of permitting the user to incorporate a priori information about the transmissivities. This information may be based on actual field data such as pumping tests, or on statistical data accumulated from similar aquifers elsewhere in the world. The new method has been applied to actual field data from the Cortaro Basin in Southern Arizona. The estimated transmissivities were shown to compare favorably with those obtained earlier for the same basin by an ad hoc trail-and-error procedure. Both sets of transmissivity values have been used successfully in conjunction with a mixed explicit-implicit finite element model to reproduce 25 years of water level variations in the Cortaro Basin in response to pumpage during the period 1940-1965. The finite element model has revealed some important features of the local hydrogeological regime which have not been recognized previously.
W80-03305

GAS CONCENTRATIONS AND AGES OF GROUNDWATERS IN BEAUFORT GROUP SEDIMENTS, SOUTH AFRICA,
Council for Scientific and Industrial Research, Pretoria (South Africa). Natural Isotopes Div.
T. H. E. Heaton, and J. C. Vogel.
Water S. A., Vol 5, No 4, p 160-170, October 1979. 6 Fig, 3 Tab, 38 Ref.

Descriptors: *South Africa, *Groundwater, *Hydrogeology, *Gases, Hydrogen, Helium, Methane, Nitrogen, Oxygen, Water properties, Spectrometers, Chemical analysis, Water sampling, Boreholes, Hydrology, Fractures(Geologic), Fracture permeability.

As part of a geophysical and hydrological study groundwater samples from 25 sites along the 120 km middle-upper stretch of the Orange River in Cape Province and Orange Free State were analyzed for dissolved He, Rn, Ra, CH4, N2, O2, and Ar concentrations and for their 14C and 3H ages. Rocks in the area are part of the Beaufort group. Burial metamorphism of Karoo sediments in the area has produced methane-rich gas and oil traces. Previous hydrological investigations indicate that groundwater age in the area increases with depth, however, the movement and mixing of water along vertical fractures and along contact zones between dikes and sediments is likely. Gas analyses were performed in an Atlas M86 mass spectometer calibrated using atmospheric air and gas mixtures of known composition. Large variations in the concentrations of He and CH4 were found. A correlation between He-CH4 concentrations and the 14C-3H ages of samples was also found. Results indicate that low He and CH4 concentrations characterize young near-surface recently recharged groundwater while high CH4 concentrations characterize deeper older groundwater. The He concentrations in the samples were too high to be accounted for solely by groundwater. The Rn concentrations indicated that the near-surface uranium environment of the different waters is fairly uniform. High N2 and Ar concentrations indicate that excess air may be trapped in the waters during initial infiltration. Old groundwater had low 02 concentrations. (Seigler-IPA)
W80-03322

BETTER UTILIZATION OF GROUND WATER IN THE PIEDMONT AND MOUNTAIN REGION OF THE SOUTHEAST,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 6D.
W80-03327

OVERFLOW TESTS ANALYSED BY THEORETICAL AND NUMERICAL METHODS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and K. S. Rathod.
Ground Water, Vol 18, No 1, p 61-69, January-February 1980. 8 Fig, 6 Ref.

Descriptors: *Water wells, *Artesian wells, *On-site tests, *Theoretical analysis, Overflow, Drawdown, Water yield, Transmissivity, Storage, Storage coefficient, Mathematical models, Numerical analysis, Flow, Discharge(Water), Wells, Water resources, Water supply, Groundwater, Overflow tests.

The assumptions inherent in the theoretical analysis of constant drawdown overflow test are difficult to achieve in practice. This paper showed that, even if there is a restriction in the flow which causes some delay in the achievement of the constant drawdown condition, the theoretical discharge curve is followed once the constant drawdown condition is reached. Recovery tests following overflow were also examined, and it was shown that the discharge used in the calculation should be the discharge at the instant that the test is stopped. Further, it was demonstrated that if well and formation losses occur, the aquifer response is distinctly different from that of the theoretical analysis. A brief description was given of an alternative method of analysis using a numerical model. A preliminary study of a field test yielded promising results. (Sims-ISWS)
W80-03356

THEIS PARAMETER EVALUATION FROM PUMPING TESTS BY SENSITIVITY ANALYSIS,
Geological Survey, Lawrence, KS.
C. D. McElwee.
Ground Water, Vol 18, No 1, p 56-60, January-February 1980. 2 Tab, 14 Ref.

Descriptors: *Groundwater, *Pumping, *Drawdown, *Model studies, Mathematical models, Transmissivity, Storage, Equations, Mathematics, Aquifers, Hydraulic conductivity, Hydrology, Theis equation.

Through the years the Theis equation has played an important role in groundwater hydrology. Comparison of experimental pumping-test data with this theoretical curve by graphic means has been a standard method of determining aquifer transmissivity and storage. The purpose of this paper was to present a technique and an algorithm to fit automatically experimental pumping-test data to the Theis equation by obtaining the 'best' transmissivity and storage in the least squares sense through the use of sensitivity analysis. The automated fit for pumping-test data developed in this work should be a useful tool for the groundwater hydrologist. Use of the technique is simple, quick, and inexpensive, and has the advantage of always being objective. As a measure of the error in fitting, the rms deviation in drawdown was calculated for the 'best' transmissivity and storage. (Sims-ISWS)
W80-03357

RESISTIVITY INVESTIGATIONS FOR GROUND WATER IN METAMORPHIC AREAS NEAR DHANBAD, INDIA,
Indian School of Mines, Dhanbad. Dept. of Applied Geophysics.
R. K. Verma, M. K. Rao, and C. V. Rao.
Ground Water, Vol 18, No 1, p 46-55, January-February 1980. 9 Fig, 7 Ref.

Descriptors: *Groundwater, *Resistivity, *Surveys, On-site investigations, Electrical resistance, Aquifers, Water yield, Water resources, Geology, Rocks, Data processing, Regression analysis, Analytical techniques, Hydrogeology, *India.

Despite sufficient rainfall, large parts of eastern India suffer from water scarcity. Groundwater occurs in weathered or semiweathered/fractured layers in hardrock areas whose thickness varies, in general, from 5 to 20 m. Groundwater studies were carried out in several areas in and around Dhanbad (Lat. 23 deg 48 min N, Long. 86 deg 24 min E) in Bihar State of India. The area covers Precambrian hornblende and feldspathic gneisses, schists, granulites, quartzites, metabasics, and pegmatites. The area forms a part of ENE-WSW trending Satpura orogenic belt. The quartz reefs formed as fault fillings act as barriers to the flow of groundwater. Geophysical investigations, using electrical methods, with Schlumberger configuration using AB up to 300 m, were carried out at most of the locations. Conventional resistivity meters were used for this purpose. The data from 78 Schlumberger soundings were analyzed. Both A and H type curves were obtained. Spectra of resistivity values were prepared to study the overall variation of resistivity values in the area. It was observed that the curves with arithmetic mean values are quite representative. The values obtained from spectral and regression analyses are nearly the same. The results of geoelectric soundings were compared with the geological section wherever available. It was inferred that the thickness of the weathered layer as deduced from Schlumberger soundings includes partly the unweathered/fractured layer as well. An attempt was made to find an empirical relationship between the daily yield of water in gallons/day and the longitudinal conductance (s = h/rho) of the weathered layer. Two empirical relationships were obtained, one for the winter months, December-January, and the other for the summer months, June-July. A suitable explanation for the two curves was given. (Sims-ISWS)
W80-03358

MODEL FOR ESTIMATING ELECTRIC MACROANISOTROPY COEFFICIENT OF AQUIFERS WITH HORIZONTAL AND VERTICAL FRACTURES,

Geological Survey, Denver, CO.
D. L. Campbell.
Geophysics, Vol 42, No 2, p 114-117, February, 1977. 4 Fig, 5 Ref.

Descriptors: *Anisotropy, *Aquifers, *Fractures, Resistivity, Mathematical models, Aquifer characteristics.

A model for estimating the macroanisotropy of fractured beds is presented. This model takes into account both horizontal and vertical fractures. The aquifer is assumed to extend infinitely in the two horizontal directions and current flow is assumed to be perfectly vertical and horizontal. The macroanisotropy coefficient is plotted as a function of horizontal and vertical crack fraction and horizontal crack fraction and vertical vug fraction. A very small fraction of vertical cracks is sufficient to lower the anisotropy coefficient to unity. When there are no horizontal cracks and vertical cracks take up 8 percent of the width of the aquifer, the anisotropy coefficient equals .742. Thus, a vertical electric sounding will assign the aquifer only about three-fourths its true thickness. In the case of a vuggy aquifer, the absence of horizontal cracks can result in a coefficient as low as .226 or an interpreted thickness less than one-fourth its true thickness. (Purdin-NWWA)
W80-03434

SCIENTIFIC ASPECTS OF THE 1975-76 DROUGHT IN ENGLAND AND WALES,
For primary bibliographic entry see Field 2E.
W80-03444

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN CARSON COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W80-03451

CURRENT SUBSURFACE INTRUSION OF MEDITERRANEAN SEAWATER--A POSSIBLE SOURCE OF GROUNDWATER SALINITY IN THE RIFT VALLEY SYSTEM, ISRAEL,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 2A.
W80-03472

THE PALEOHYDROLOGY OF SOUTHERN ISRAEL AND ITS INFLUENCE ON THE FLUSHING OF THE KURNUB AND 'ARAD GROUPS (LOWER CRETACEOUS AND JURASSIC),
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Research.
For primary bibliographic entry see Field 2A.
W80-03473

MAP SHOWING GROUND-WATER CONDITIONS IN THE BODAWAY MESA AREA, COCONINO COUNTY, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03481

THE COFFEE SAND AND RIPLEY AQUIFERS IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
E. H. Boswell.
Geological Survey Water-Resources Investigations 78-114 (open-file report), 1978. 1 Sheet, 6 Fig, 2 Tab, 19 Ref.

Descriptors: *Mississippi, *Groundwater resources, *Aquifer characteristics, *Water quality, *Water utilization, Maps, Water wells, Water levels, Well data, Water yield, Groundwater availability, Water supply, Selma Group, *Coffee Sand, Ripley formation, Cretaceous aquifers.

The Coffee Sand and Ripley aquifers, of Cretaceous age, are in the Selma Group in northern Mississippi. The aquifers contain freshwater in an area of about 4,400 square miles in northern Mississippi. Water produced from the aquifers by public water systems and numerous industries in 1975 averaged about 4 Mgal/d. Regional water-level declines have been very small and the aquifers have a moderate potential for future development. The aquifers are used in some areas where there are no other significant sources of ground water. The most common problems in developing water supplies are low yields to wells and hard water. (Kosco-USGS)
W80-03484

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VI-APPENDIX E, GROUNDWATER.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 274, Price codes: A12 in paper copy, A01 in microfiche. Prepared by the U.S. Geological Survey, Water Resources Division, for the Ohio River Basin Coordinating Committee, 1965. 258 p, 12 Tab, 23 Plates, 19 Ref, 12 Append.

Descriptors: *Water resources development, *Groundwater resources, *Aquifers, *Groundwater availability, *Water sources, *Water supply, *Geologic control, *Ohio River Basin, *Water management, Water quality, Groundwater recharge, Groundwater-surface relationships, Alluvial aquifers, Retention, Hydrology, Geology, Sediment.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin, particularly for that portion within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix investigates the uses and quality of groundwater resources in the Basin. The specific objectives were to make a general appraisal of the groundwater resources; to present information in readily useable format for long-range planning and as a management guide; and to identify hydrologic factors that should be taken into account in formulating and implementing water resource development plans. Data are presented for the Basin as a whole and in detailed reports for 12 sub-regions. Conclusions indicate that, although groundwater resources provide great potential for future development, this will be limited by water quality problems relating to the natural quality of groundwater as well as contamination to both ground and surface waters. The volume of permeable sediments is enormous; the Ohio River provides a large source of water to recharge the underlying valley fill. Development will be limited by technical problems of recharging these sediments, by quality of the Ohio River water, and by economic considerations. Groundwater sources will provide water supplies for future needs over large areas throughout the Basin, although in small areas groundwater conditions are so unfavorable that even small supplies are unobtainable. More studies are needed on the effects on quality caused by interflow of water between surface and sub-surface sources. (Arnold-NC)
W80-03576

MEASUREMENTS OF VERTICAL FLOW IN GROUND WATER BORINGS AND HYDROLOGICAL PARAMETERS FOR ASSESSING GROUND WATER POLLUTION,
Bhabha Atomic Research Centre, Bombay (India).
For primary bibliographic entry see Field 5B.
W80-03599

2G. Water In Soils

AN ELECTRICAL CONDUCTANCE METHOD FOR DETERMINING CONDENSATION AND EVAPORATION PROCESSES IN ARID SOILS WITH HIGH SPATIAL RESOLUTION,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hanover (Germany, F. R.). Inst Fuer Strahlenbotanik.
For primary bibliographic entry see Field 2D.
W80-03470

CHANGES IN DECOMPOSITION RATE, MICROBIAL POPULATION AND CARBOHYDRATE CONTENT OF AN ACID PEAT BOG AFTER LIMING AND RECLAMATION,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
K. C. Ivarson.
Canadian Journal of Soil Science, Vol 57, No 2, p 129-137, May, 1977. 1 Fig, 3 Tab, 42 Ref.

Descriptors: *Peat, *Nutrients, *Decomposition, *Soil microorganisms, Lime, Wetlands, Bogs, Soil, Fungi, Bacteria, Temperature, Hydrogen ion concentration, Ecological effects, Ecology, Canada, Nitrogen, Phosphorus, Potassium.

After eight months of decomposition under laboratory conditions, the unlimed surface sample of an acid peat bog near Alfred, Ontario, contained about five times as many microbes as the unlimed subsurface material. As measured by C02-C released and numbers of bacteria and actinomycetes, lime had greater effects on the microbial activity of the surface material. Nitrifying bacteria were present and needed lime to become active. Twelve genera of fungi were found and fungal numbers decreased with lime. Temperature had little effect whereas pH had a marked effect on fungal genera distribution. Before incubation, the unlimed lower sample was higher in carbon, nitrogen and methoxyl but lower in hexose, pentose and uronic acid than the unlimed upper sample. Hexose and pentose tended to decrease more noticeably in the upper material during decomposition while the other compounds showed no appreciable changes in either layer. Dry matter lost in the surface sample ranged from 8 to 13% and from 2.0 to 3.5% in the lower material. Despite sufficient nitrogen, phosphorus, and potassium and a substantial sugar content, sphagnum litter decomposes at a slower rate than some tree leaf litters. This may be due to the presence of microbial inhibiting substances. (Howard-Mass)
W80-03534

AN ANALYSIS OF INFILTRATION IN INITIAL GRADIENT SOILS,
Punjab Agricultural Univ., Ludhiana (India).
J. P. Soni, and P. Basak.
Mausam, Vol 30, No 1, p 51-54, January 1979. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Infiltration, *Soil water, *Hydraulic gradient, *Model studies, Mathematical models, Wetting, Soils, Soil water movement, Irrigation, Drainage, Hydraulic conductivity, Moisture content, Hydrology.

Flow through loamy and clay soils starts only when the hydraulic gradients exceed a certain value called initial gradient, thus giving rise to non-Darcian flow. An analytical solution of the problem of infiltration into homogeneous soil with initial gradient was presented, which can be quite useful in the area of irrigation and drainage. The effect of initial gradient on the advance of wetting front, the infiltration rate, and accumulated depth of infiltration was clearly brought out, and it was found that the nonrecognition of initial gradient in soils leads to the overestimation of these values. (Sims-ISWS)
W80-03600

2H. Lakes

EFFECTS OF DESTRATIFICATION ON SEDIMENT CHEMISTRY AND BENTHIC MACROINVERTEBRATES IN HAM'S LAKE,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
J. Wilhm, D. Barker, E. Cover, E. Clay, and R. Fehler.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB80-143639, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Final Technical Completion Report, December 1979. 40 p, 7 Tab, 39 Ref, OWRT A-079-OKLA (1), 14-34-0001-9038.

Descriptors: *Destratification, *Benthic fauna, *Bloodworms, *Bottom sediments, Oklahoma, Water sampling, Water chemistry, Water temperature, Dissolved oxygen, Stratification, Particle size, Ponds, Mixing, Hypolimnion, Turnovers.

Ham's Lake built in 1965 near Stillwater, Oklahoma, was artifically destratified by mechanical pumping and sampling was conducted to determine changes in physiochemical conditions, sediments and heavy metals, and physiological conditions in Chamoborus punctipennis (phanon midge) and Chironomus riparius (bloodworm). Samples were taken from two stations, one in the central pool that was mixed by pumping oxygen-rich surface water downward, and one that was unmixed due to a submerged dam from a former farm pond. Hypolimnetic water parameters tested include: temperature, dissolved oxygen, conductivity, pH, alkalinity, iron, manganese, copper, zinc, sodium, potassium, and chloride. Sediment parameters tested include particle size, organic carbon, phosphorus, clay mineral composition, pH, iron, manganese, zinc, caloric content, and oxygen uptake. The benthic macroinvertebrates Chaoborus and Chironomus were tested for concentrations of iron, manganese, and zinc; caloric content; hemolymph ion concentration; osmotic pressure; and oxygen uptake. Results show that dissolved oxygen was 3 to 5 mg/l higher in the mixed area and temperature was 6 to 8C higher in the mixed area. Water in the mixed area also had a lower concentration of total manganese. The stratified area showed a greater concentration of organic matter with greater oxygen uptake and hemplymph Na concentration of Chaeborus. Extensive data and results are provided. (Seigler-IPA)
W80-03308

OPERATIONAL SIMULATION OF A RESERVOIR SYSTEM WITH PUMPED STORAGE,
Corps of Engineers, Savannah, GA.
For primary bibliographic entry see Field 6A.
W80-03351

A HYDRAULIC TRANSIENT MODEL OF THE UPPER ST. LAWRENCE RIVER FOR WATER RESOURCES STUDIES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2E.
W80-03366

THE PROBLEM OF PHOSPHORUS IN THE EUTROPHIC LAKE MARYUT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 5B.
W80-03371

THERMAL PREDICTIONS USING INTEGRAL ENERGY MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. E. Ford, and H. G. Stefan.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15119, p 39-55, January 1980. 15 Fig, 2 Tab, 19 Ref, 2 Append.

Descriptors: *Lakes, *Water temperature, *Model studies, Mathematical models, Stratification, Profiles, Temperature, Energy, Heating, Winds, Circulation, Mixing, Water quality, Environment, Limnology.

A one-dimensional integral energy model (mixed-layer model) was used to simulate the seasonal temperature cycle of three, morphometrically different, temperate lakes. In the model, turbulent kinetic energy supplied by wind shear was used to entrain denser water into the upper mixed layer by working against gravity. The model was calibrated with data from one lake for 1 yr and verified against data from two other lakes and also against data from other years. Predictions of the onset of stratification, surface and hypolimnetic temperatures, mixed layer depths, and periods of turnover were all in agreement with data. (Sims-ISWS)
W80-03380

SEASONAL CYCLES OF ZOOPLANKTON BIOMASS IN SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes and Marine Waters Center.
B. E. Hawkins, and M. S. Evans.
Journal of Great Lakes Research, Vol 5, No 3-4, p 256-263, 1979. 3 Fig, 3 Tab, 24 Ref.

Descriptors: *Lake Michigan, *Zooplankton, *Copepods, *Biomass, Standing crops, Productivity, Crustaceans, Aquatic animals, Lake stages, Water temperature, Seasonal, Monthly, Fluctuation, Period of growth, Oligotrophy, Mesotrophy.

Spatial and seasonal variations in the crustacean zooplankton biomass in a 250 sq m area of Lake Michigan were studied from 1975 through 1977 as part of an environmental monitoring project for the Donald C. Cook Nuclear Power Plant. A combination of dry weight estimates of individuals of zooplankton species and numerical density (number per cu m) estimates were used to calculate monthly biomass estimates. Animals from an inshore station 9 m in depth and from an offshore station 40 m in depth were weighed and considered to be representative of the range of physical conditions found in the test area. Results show a greater biomass for deeper, offshore stations due to the dominance of large copepod zooplankton that were rare at the inshore stations. The mean annual standing stock was calculated at 60 mg/ cu m which is lower than other Great Lakes and is considered to be characteristic of oligotrophic or mesotrophic lakes. Total zooplankton biomass fluctuated seasonally due to changes (up to 70%) in the mean weight of individual taxa as well as changes in weight per individual. Inverse correlations were found between temperature in the month prior to a collection and the body length and weight of C. bicispidatus thomasi, D. ashlandi, and D. minutus. For several species the seasonal weight cycles were related to the growth of new generations and the temperatures occurring during the development period. (Seigler-IPA)
W80-03390

ALGAL AND INVERTEBRATE COMMUNITIES IN THREE SUBARCTIC LAKES RECEIVING MINE WASTES,
For primary bibliographic entry see Field 5C.
W80-03457

THE EFFECT OF WASTEWATER PHOSPHORUS REMOVAL ON SHAGAWA LAKE, MINNESOTA: PHOSPHORUS SUPPLIES, LAKE PHOSPHORUS AND CHLOROPHYLL A,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W80-03459

SPECIES VERSATILITY IN SHORE HABITATS,
Harvard Univ., Petersham, MA. Harvard Forest.
For primary bibliographic entry see Field 2I.
W80-03521

A PALAEOECOLOGICAL STUDY OF HOLOCENE PEAT BOG SECTIONS IN GERMANY AND THE NETHERLANDS, BASED ON THE ANALYSIS OF POLLEN, SPORES AND MACRO- AND MICROSCOPIC REMAINS OF FUNGI, ALGAE, CORMOPHYTES AND ANIMALS,
Amsterdam Univ. (Netherlands). Hugo de Vries Lab.
B. Van Geel.
Review of Palaeobotany and Palynology, Vol 25, p 1-120, 1978. 27 Fig, 6 Tab, 130 Ref.

Descriptors: *Bogs, *Palynology, *History, Wetlands, Peat, Pollen, Palaeoclimatology, Marsh plants, Succession, *Germany, *Netherlands.

A peat section of the Engbertsdijksveen (The Netherlands) was analyzed for micro-macrofossils in order to obtain maximum information regarding local vegetation and animal succession and regional changes in the prevailing vegetation types. Analysis of the remains and the correlation of the events inside and outside the peat bog site lead to the following conclusions: The Atlantic-Subboreal transition, known for its elm decline, could be correlated with a local change in bog vegetation. Following the alteration of wet Scheuchzeria palustris vegetation with hummock vegetation in the Atlantic period, the appearance of a Molinia coerulea peat coincides with the elm decline. During the climatic deterioration of the Subboreal-Subatlantic transition, the incidence of Corylus avellana decreased. Depressions in the Corylus pollen curve corresponds with particularly wet local vegetation, Corylus pollen maxima correspond with relatively dry bog vegetation. These cyclic fluctuations correspond to approximately 150-200 historical years each. The increasing oceanicity ultimately resulted in the formation of peat by Sphagnum species of the section Cymbifolia. All available data were expressed in curves, in order to indicate changes in local and perhaps regional mosture conditions. (Steiner-Mass)
W80-03525

MIRES OF THE MANAPOURI-TE ANAU LOWLANDS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-03528

STUDIES ON THE MICRO-FAUNA OF BLANKET BOG WITH PARTICULAR REFERENCE TO ENCHYTRAEIDAE. I. FIELD AND LABORATORY TESTS OF MICRO-ORGANISMS AS FOOD,
Nature Conservancy, Alston (England). Moor House Field Station.
For primary bibliographic entry see Field 2I.
W80-03531

THE CONTRIBUTION OF MACROPHYTES TO THE METALIMNETIC OXYGEN MAXIMUM IN A MONTANE, OLIGOTROPHIC LAKE,
Virginia Univ., Charlottesville. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03533

2I. Water In Plants

MANAGEMENT OF PINUS PINASTER PLANTATIONS ON THE SWAN COASTAL PLAIN FOR TIMBER AND WATER YIELD,
Western Australia Dept. of Forests, Perth.
T. B. Butcher.
Australian Water Resources Council Technical Paper No 42, 1979. 68 p, 26 Fig, 16 Tab, 22 Ref, 3 Append.

Descriptors: *Australia, *Forest management, *Water management(Applied), *Groundwater resources, Groundwater recharge, Seepage, Evapotranspiration, Climatology, Water loss, Soil moisture, Infiltration rates, Recharge, Pine trees, Lumber.

The management of underground water resources and forest resources of State Forest No 65 on the Swan Coastal Plain in Australia was studied to develop a program for economic sawlog production and acceptable water yields to underlying aquifers. This area, north of Perth, contains the largest contiguous area of exotic pine plantations in Western Australia. Under this forested area is a large water resource which can potentially supply 20% of Perth's water needs. By controlling the

number of trees uptake of water by the pines can be balanced with water recharge of the soil. The area has a Mediterranean type climate with cold moist winters and hot dry summers. Because 86% of the annual rainfall occurs in winter when evapotranspiration rates are low, about 75% of the rainfall is available for soil storage and groundwater recharge. The forest currently produces sawlogs at the rate of 900,000 cu m per year. Future sawlog requirements are estimated at 1,400,000 cu m by the year 2010. Water infiltration and evapotranspiration losses can be altered by changing forest density. A heavy pine canopy can intercept 30% of rainfall while thinning can increase effective rainfall by 20%. Plans for the management of the three sectors of the forest are given. The objectives for the southern sector are to provide water, timber, and recreation; for the central sector, water timber, ecotype preservation, and recreation; and for the northern sector, timber and ecotype preservation. (Seigler-IPA)
W80-03385

PHREATOPHYTE EVAPOTRANSPIRATION AND ITS POTENTIAL REDUCTION WITHOUT ERADICATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2D.
W80-03442

DEALING WITH SITE DISTURBANCES FROM HARVESTING AND SITE PREPARATION IN THE LOWER COASTAL PLAIN,
Southern Forest Experiment Station, Pineville, IA. Forest Insect Research.
For primary bibliographic entry see Field 4C.
W80-03503

SALT MARSHES AND SALT DESERTS OF THE WORLD,
Auckland Univ. (New Zealand). Dept. of Botany.
For primary bibliographic entry see Field 2L.
W80-03504

ENVIRONMENT, VEGETATION AND PHYTOGEOGRAPHY OF THE HIGH-ALTITUDE BOGS OF LESOTHO,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Science.
E. M. van Zinderen Bakker, and M. J. A. Werger.
Vegetatio, Vol 29, No 1, p 37-49, July 7, 1974. 4 Fig, 4 Tab, 38 Ref.

Descriptors: *Bogs, *Rooted aquatic plants, *Ecological distribution, *Alpine, *Africa, Wetlands, Marshes, Swamps, Freshwater marshes, Ecology.

High summer rainfall and diurnal climate are characteristic of the rivershed region of the Lesotho mountains in the eastern escarpment of Southern Africa. The daily frost-thaw regime at ground level causes up-freezing, small polygons, terracettes and the formation of thufur in the bogs. The bogs originated in post-glacial times around springs or from small alpine lakes. The bogs are of significance for the regular flow of clear water and for grazing. They are in the process of being eroded through animal trampling and measures for protection are being proposed. Plant communities occurring at high altitudes on thurfur and in depressions in the stream head bogs of Lesotho are analyzed and described. The bog vegetation is compared to surrounding tussock grasses and dwarfshrub vegetation. Chronological analysis of the bog flora showed a pattern of three phytogeographical groups of species: a South African group, a southern and eastern African group, and a northern temperate group. (Howard-Mass)
W80-03507

SEASONALITY, DENSITY AND DIVERSITY OF BIRDS OF A PAPYRUS SWAMP IN WESTERN KENYA,
Shimo-la-Tewa School, Mombasa (Kenya).
P. L. Britton.
Ibis, Vol 120, No 4, p 450-466, October, 1978. 6 Fig, 5 Tab, 65 Ref, 1 Append.

Descriptors: *Birds, *Density, *Rooted aquatic plants, *Swamps, Wetlands, Ecological distribution, Ecology, Africa.

The avifauna of a western Kenya papyrus swamp is specialized with low species diversity indices and few species compared to other west Kenya habitats. Interspecific competition between similar sized species of warblers, a group which dominates the avifauna, is reduced by preference for swamp edge rather than interior habitats, preference for papyrus over standing water, or vertical habitat partitioning. Density figures for common species are higher than in forest undergrowth or thicket. This fact may be interpreted as density compensation on a species-poor 'island' compared to a species-rich 'mainland'. There is a modal egg-laying period from March to June coinciding with the long rains, and a postnuptial primary moult period from June to November which extends into the short rain period. Breeding and moult schedules therefore occupy about eight months and may be readily accommodated in the wetter months of the year. The timing of moult is apparently more synchronized and less haphazard than breeding. Postnuptial moult commenced earlier in a year where the long rains were early. There is little evidence of interrupted moult. Moult schedules are suggested as more flexible in females. (Howard-Mass)
W80-03508

SPARTINA ALTERNIFLORA SEED FUNGI,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
R. V. Gessner.
Canadian Journal of Botany, Vol 56, No 23, p 2942-2947, December 1, 1978. 2 Tab, 27 Ref.

Descriptors: *Salt marshes, *Fungi, *Aquatic plants, *Seeds, *Decomposition, Microorganisms, Ecological distribution, Wetlands, Marshes, Estuaries, Ecology, Life history studies, North Carolina.

Filamentous fungi species occurring on Spartina alterniflora seeds submerged in estuarine waters or on salt-marsh sediments in North Carolina included eight Ascomycetes, one Basidiomycete, and 16 Fungi Imperfecti. Marine fungi primarily known as wood-inhabiting species were among the fungi found after two months on the marsh surface or in the adjacent sound and tidal creek. This suggests a role as general decomposers of plant debris in marine habitats for these fungi. After 5 to 7 months, marine fungi and graminicolous Ascomycetes were the only fungi found by direct observation, although seed-borne species commonly found on grain crops could still be isolated by incubation methods. The seeds were completely degraded or barely recognizable after 11 months on the marsh sediments or in sea water. Claviceps purpurea parasitized the seed heads at all the marsh areas sampled. The greatest number of sclerotia were found on the tall S. alterniflora near the lower edge of the marsh in exposed areas and on inflorescences from dredge spoil areas. Up to 183 sclerotia/sq m and sclerotia dry weight values of up to 2.72 g/sq m were found. (Howard-Mass)
W80-03509

MARSH NESTING BY MALLARDS,
Fish and Wildlife Service, Jamestown, NC. Northern Prairie Wildlife Research Center.
G. L. Krapu, L. G. Talent, and T. J. Dwyer.
Wildlife Society Bulletin, Vol 7, No 2, p 104-110, Summer, 1979. 2 Fig, 1 Tab, 27 Ref.

Descriptors: *Mallard duck, *Nesting, *Freshwater marshes, Life history studies, Waterfowl, Nesting cover, Wetlands, Aquatic vegetation, Marshes, Ecology, Wildlife, Habitat, Wildlife management, Potholes.

Sixty-six percent of 53 nest initiated by radiomarked and unmarked mallard hens in a region of the Missouri Coteau in southcentral North Dakota were in wetlands in dense stands of emergent vegetation. Nests were usually within 50 m of the wetland edge. Potential factors contributing to mallard use of marsh habitat for nesting include: better access to tall residual cover at wetland sites than in uplands in early spring; the fact that water is a deterrent to some mammalian predators; and the longer survival length of marsh nests. It remains to be determined whether marsh nesting mallards are a distinct subgroup or if individuals nest interchangeably at marsh and upland sites, and whether imprinting is involved in the habitat selection process. Nesting requirements of mallards at marsh sites should be reconciled with other breeding requirements of this species and needs of other waterfowl before implementing wetland habitat management programs that would favor development of marsh nesting cover at the expense of other important habitat needs. (Howard-Mass)
W80-03510

SEASONAL AND SPATIAL CHANGES IN THE COMPOSITION OF THE AQUATIC AND SEMIAQUATIC VEGETATION OF LAKE CHILWA, MALAWI,
Lake Chilwa Research Project, Limbe (Malawi).
C. Howard-Williams.
Vegetatio, Vol 30, No 1, p 33-39, March 10, 1975. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Freshwater marshes, *Lakes, *Aquatic plants, *Ecological distribution, Marshes, Wetlands, Spatial distribution, Seasonal, Africa.

Changes in the frequency of individual species and in species composition of the vegetation were monitored at monthly intervals at four stations on the shore of Lake Chilwa. The stations formed a transect from land to lake through the littoral Typha swamp. Stand distance indices decreased from land to lake, while species diversity decreased from land to the central swamp and then rose again on the lake edges. Seasonal changes in the vegetation were more pronounced on the landward edge, which was subjected to alternate wet and dry periods, than in the vegetation of the lake edge. It is suggested that plant communities occurring in a fluctuating physical environment may behave differently with respect to diversity from those in which the environment is temporally stable. (Howard-Mass)
W80-03512

ECOLOGY OF WATER-LEVEL MANIPULATIONS ON A NORTHERN MARSH,
Humboldt State Univ., Arcata, CA.
S. W. Harris, and W. H. Marshall.
Ecology, Vol 44, No 2, p 331-343, Spring, 1963. 3 Fig, 3 Tab, 39 Ref.

Descriptors: *Freshwater marshes, *Drawdown, *Aquatic plants, *Vegetation effects, Marshes, Water level fluctuations, Wetlands, Ecology, Ecological distribution, Minnesota, Plant growth, *Agassiz National Wildlife Refuge(MN).

Vegetation changes associated with marsh drawdowns at Agassiz National Wildlife Refuge, Minnesota, indicate that the development of five types of vegetation on mud flats during the first year was influenced by seed availability, soil type and moisture, season and duration of drawdown, and the amount of stranded algal debris. The more an area combined early season drawdown, rich soil types, slow rates of mud flat drainage, and small amounts of stranded algae, the greater was the development of emergent aquatics. In the second year of drawdown, most areas developed greater amounts of upland and shoreline weeds and fewer emergents. Areas originally exposed before August of the first year lost emergent cover during the second year, while the reverse was true of areas exposed later in the first year. Over a 5-year drawdown, nearly solid stands of willow developed. Upon reflooding, mud flats and shoreline annuals were eliminated and emergents and aquatic annuals developed in the first year. Depending on water depths and cover types, 1- or 2-year drawdowns at 5- to 10-year intervals are required to maintain emergent marshes at this refuge. (Howard-Mass)
W80-03515

THE EFFECT OF THE MARSH ELDER (IVA FRUTESCENS) ON THE STANDING CROP BIOMASS OF SPARTINA PATENS AND ASSOCIATED WILDLIFE,

New Jersey Agricultural Experiment Station, New Brunswick.
J. K. Shisler, T. L. Schulze, and B. L. Howes.
Biological Conservation, Vol 14, No 3, p 159-166, November, 1978. 5 Fig, 3 Tab, 29 Ref.

Descriptors: *Saltmarshes, *Trees, *Dredging, *Environmental effects, *Wildlife habitats, Rooted aquatic plants, Wildlife, Birds, Mammals, Nesting cover, Habitat, Wetlands, New Jersey, Standing crop, Biomass, Organic matter, Ecosystem.

Leaf and wood biomass were highly correlated with age in a population of Iva frutescens L. associated with Spartina patens (Ait.) Muhl on dredged material piles in a New Jersey saltmarsh which was previously managed for mosquito control. Living biomass of S. patens on the marsh surface, on dredged material piles and on dredged material piles with I. frutescens growth were not statistically different. Standing dead biomass of S. patens on the dredged material piles with I. frutescens was significantly lower than dead S. patens biomass on the marsh surface and dredged material, piles without I. frutescens. This was probably a result of increased tidal circulation in the managed marsh. In addition to contributing organic material to the saltmarsh-estuarine ecosystem without causing any detrimental effects on the standing crop biomass of S. patens, I. frutescens was shown to provide nesting and foraging sites for various species of birds, and islands of refuge for small animals and birds. (Howard-Mass)
W80-03516

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE. PART B: CALIFORNIA, CASE STUDIES,
Jones and Stokes, Inc., Sacramento, CA.
For primary bibliographic entry see Field 6G.
W80-03517

BIOGENIC STRUCTURE AND ITS EFFECT ON THE SPATIAL HETEROGENEITY OF MEIOFAUNA IN A SALT MARSH,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
S. S. Bell, M. C. Watzin, and B. C. Coull.
Journal of Experimental Marine Biology and Ecology, Vol 35, No 2, p 99-107, November, 1978. 2 Fig, 2 Tab, 25 Ref.

Descriptors: *Salt marshes, *Microorganisma, *Spatial distribution, *Rooted aquatic plants, Aquatic animals, Crabs, Burrows, Environmental effects, Wetlands, Marshes, Root systems, Biomass, Ecology, Habitat, South Carolina.

Meiofauna samples collected around and between Spartina plants in the North Inlet estuarine system of South Carolina had either negative correlations with root biomass or no correlation. If, as predicted by earlier workers, meiofauna are attracted to micro-oxygenated zones around roots, there should have been a positive association between meiofauna and roots. Nematodes had higher densities around fiddler crab burrows than in controls, but copepods were less abundant. Biogenic structures significantly affect meiofauna distribution and must be taken into account when quantifying meiofauna in areas with much structural heterogeneity. (Howard-Mass)
W80-03519

THE IMMEDIATE EFFECTS OF DITCHING A SALTMARSH ON NESTING HERRING GULLS LARUS ARGENTATUS,
Livingston Coll., New Brunswick, NJ. Dept. of Biology.
For primary bibliographic entry see Field 4A.
W80-03520

SPECIES VERSATILITY IN SHORE HABITATS,
Harvard Univ., Petersham, MA. Harvard Forest.
H. M. Raup.
Journal of the Arnold Arboretum, Vol 56, p 126-163, 1975. 14 Fig, 2 Tab, 41 Ref.

Descriptors: *Shores, *Marsh plants, *Distribution patterns, Lakes, Wetlands, Aquatic plants, Freshwater marshes, Muskeg, Aquatic habitats, Mosses, Spatial distribution, Canada, *Athabaska-Great Slave Lake region(Canada).

This study deals with the shore vegetation of lakes and rivers in the Athabaska-Great Slave Lake region of northwestern Canada. Ten habitat-vegetation complexes are defined to embrace the principal variations that were found: (1) aquatic habitats, with submerged and/or emergent plants; (2) saline or brackish sloughs or wet meadows; (3) muskeg grass-sedge meadows; (4) open shrub muskeg; (5) shrub-tree borders of muskeg; (6) lower beaches on large lakes; (7) upper beaches on large lakes; (8) grass-sedge meadows on river flood plains; (9) shrub-tree borders on meadows; and (10) herbs or trailing shrubs on middle beaches of large lakes. Within the habitats, the vegetation is described in terms of assemblages of vascular plant species which are visibly different from one another owing to the abundance and/or prominence of one or more 'primary' species. (Steiner-Mass)
W80-03521

VEGETATION AND NUTRIENT STATUS OF NORTHERN MICHIGAN FENS,
Michigan Univ., Pellston. Biological Station.
C. R. Schwintzer.
Canadian Journal of Botany, Vol 56, No 24, p 3044-3055, December 15, 1978. 2 Tab, 26 Ref.

Descriptors: *Fen, *Vegetation, *Nutrients, *Distribution, Bogs, Marshes, Wetlands, Michigan, Water level, Calcium, Mineral water, Hydrogen ion concentration, Ecological distribution, Ecology.

The field layer was the dominant stratum in 5 northern Lower Michigan fens. This stratum contained a total of 85 vascular species with a mean density of 30 vascular species per stand. Carex lasiocarpa was the most prevalent dominant plant and attained a frequency-presence index (FPI) of 8000 of a possible 10,000 and a mean important value of 33 of a possible 200. Other common dominants in decreasing order of FPI were Carex aquatilis (6640), Myrica gale (4636), and Andromeda glaucophylla (2000). Common subordinates were Hypericum virginicum (2639), Muhlenbergia glomerata (2466), and Campanula aparinoides (1400). The homogenity index for the five fens had a value of 58%. The shallow groundwaters were minerotrophic with pH values ranging from 5.7 to 7.0 and calcium concentrations of 11.0 to 75.0 mg/l. Four of the fens were on floating mats and had relatively stable water levels while the fifth was on a grounded mat and was subject to substantial water level fluctuation. Three previously described alkaline lake-edge kettle-hole 'bog' communities were found to be similar to the fens in species composition and water chemistry. (Howard-Mass)
W80-03523

PRODUCTION AND STRUCTURE IN THE EARLY STAGES OF VEGETATION DEVELOPMENT IN THE LAUWERSZEE-POLDER,
Groningen Rijksuniversiteit (Netherlands). Afdeling Plantenoecologie.
For primary bibliographic entry see Field 2L.
W80-03524

A PALAEOECOLOGICAL STUDY OF HOLOCENE PEAT BOG SECTIONS IN GERMANY AND THE NETHERLANDS, BASED ON THE ANALYSIS OF POLLEN, SPORES AND MACRO- AND MICROSCOPIC REMAINS OF FUNGI, ALGAE, CORMOPHYTES AND ANIMALS,
Amsterdam Univ. (Netherlands). Hugo de Vries Lab.
For primary bibliographic entry see Field 2H.
W80-03525

VEGETATION STUDY UNDERTAKEN AT THE LAMTO SAU SAVANNA RESERVE (IVORY COAST)--(VEGETATIONSKUNDLICHE UNTERSUCHUNGEN IM SAVANNENRESERVAT LAMTO (ELFENBEINKUSTE)),
Geottingen Univ. (Germany, F.R.). Lehrstuhl fuer Geobotanik.
W. Schmidt.
Vegetatio, Vol 28, No 3-4, p 145-200, September 28, 1973. 5 Fig, 5 Tab, 26 Ref, 1 Append. (English summary).

Descriptors: *Freshwater marshes, *Vegetation, *Ecological distribution, *Grasslands, Wetlands, Marshes, Ecology, Soil moisture, Africa.

The vegetation of the Lamto Savanna Reserve in the Ivory Coast is classified into four major plant communities on the basis of phytosociological records. The Loudetia phragmitoides-swamp community with its two subdivisions occurs in depressions and is influenced by waterlogging during the rainy season. During the dry season, these sites are burned by bush fires. Life-form spectrums of Savanna vegetation show a marked competition between hemicryptophytes and phanerophytes. Chamaephytes dominate in rock vegetation, therophytes in swamps and phanerophytes in forest stands. (Howard-Mass)
W80-03527

MIRES OF THE MANAPOURI-TE ANAU LOWLANDS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Botany.
C. J. Burrows, and A. T. Dobson.
Proceedings of the New Zealand Ecological Society, Vol 19, p 75-99, 1972. 18 Fig, 15 Tab, 21 Ref, 3 Append.

Descriptors: *History, *Wetlands, *New Zealand, Succession, Marsh plants, Aquatic plants, Marshes, Freshwater marshes.

Lakes Manapouri and Te Anau lie on the eastern margin of the hard rock highland of Fiordland, New Zealand, their basins partially surrounded by steep mountainsides. There are extensive areas of wetlands around the southeastern ends of the lakes. The wetlands have arisen mainly on landforms resulting from the widespread glaciation of the area. The vegetational history of the area is discussed and the origins, general form, margin profile, surface form, stratigraphy, and the vegetational physiognomy of a few individual mires are described. (Steiner-Mass)
W80-03528

AVIAN ECOLOGY OF A MANAGED GLACIAL MARSH,
M. W. Weller, and L. H. Fredrickson.
In: The Living Bird, Twelfth Annual of the Cornell Laboratory of Ornithology, Cornell University, Ithaca, New York, p 269-291, 1973. 16 Fig, 7 Tab, 13 Ref.

Descriptors: *Freshwater marshes, *Habitat, *Birds, *Marsh management, *Environmental effects, Water levels, Vegetation establishment, Succession, Vegetation effects, Muskrats, Wildlife management, Marshes, Wetlands, Drawdown, Ecology, Ecosystem, Iowa.

Bird populations in a semipermanent glacial marsh in northern Iowa changed dramatically when water levels were lowered to initiate revegetation and then regulated to maintain maximal use by birds and muskrat. The greatest avian number and species diversity were present when 50 to 70 percent of the open water was well interspersed with vegetation. The general pattern of short-term vegetation-bird succession in this type of marsh is: (1) sparse germination of diverse plant species, which may attract many birds when flooded, (2) an increase in density of perennial emergents to form a dense marsh less attractive to birds, (3) an increase in open water resulting from use of the vegetation by muskrat with a resulting increase in numbers and species of birds in the well-interspersed hemi-marsh, until (4) emergent vegetation is eliminated in the central marsh by muskrat and water levels, and bird populations are reduced to those species using the marsh edge. Such successional changes are not permanent but reflect the dynamic changes of an unstable ecosystem. (Howard-Mass)

V80-03529

TUDIES ON THE MICRO-FAUNA OF BLAN-ET BOG WITH PARTICULAR REFERENCE O ENCHYTRAEIDAE. I. FIELD AND LABO-RATORY TESTS OF MICRO-ORGANISMS AS OOD,
Nature Conservancy, Alston (England). Moor House Field Station.
. A. Springett, and P. M. Latter.
ournal of Animal Ecology, Vol 46, p 959-974, 977. 1 Fig, 6 Tab, 26 Ref, 1 Append.

Descriptors: *Food habits, *Aquatic microorgan-sms, *Bogs, Aquatic animals, Wetlands, Worms, Biomass, Secondary productivity, Food chains, Productivity.

As part of a project to study primary and second-ry production in a moorland ecosystem, the im-portance of microorganisms in the food of Enchy-raeidae was investigated in field and laboratory xperiments. The field experiments used two field aiting techniques and included records of other oil fauna. The laboratory experiments tested the rowth of the dominant enchytraeid worm, Cog-ettia sphagnetorum, in microbial cultures. The tudies provided no firm evidence that microor-ganisms form any part of the natural diet of moor-and Enchytraeidae, but the use of soluble nutrients s a possibility. (Steiner-Mass)
W80-03531

NUTRIENT AND PARTICULATE FLUXES IN A SALT MARSH ECOSYSTEM: TIDAL EX-CHANGES AND INPUTS BY PRECIPITATION AND GROUNDWATER,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
. Valiela, J. M. Teal, S. Volkmann, D. Shafer, and E. J. Carpenter.
Limnology and Oceanography, Vol 23, No 4, p 798-812, July, 1978. 9 Fig, 7 Tab, 40 Ref.

Descriptors: *Salt marshes, *Cycling nutrients, *Precipitation, *Groundwater, Nutrients, Phos-phorus, Nitrogen, Carbon, Tidal water, Wetlands, Marshes, Aquatic plants, Ecosystem, Ecology, Or-ganic matter.

Waterborne nutrients enter Great Sippewissett Marsh in Massachusetts through groundwater, rain, and tidal flooding. The ebb of tidal water removes nutrients. During summer, uptake by marsh biota leads to net import of nutrients. The increased export of ammonium in August may be due to leaching from senescent marsh plants. There is a net annual export of ammonium, nitrate, nitrite, dissolved organic (DON) and particulate (PN) ni-trogen, particulate carbon (PC), and phosphate. Ammonium, DON, and PN are the major forms of nitrogen exported. Nutrient concentrations in coastal and marsh water are correlated, and marsh exports could contribute substantially to nutrient supplies of coastal waters. Groundwater entering the marsh provides primarily N03-N and DON. Nutrient inputs through precipitation consist pri-marily of DON, N03-N, and NH4-N. Ground-water carries over 20 times the amount of nutrients brought in by rain; therefore, nitrogen inputs from this source are important to the nitrogen economy of a salt marsh. About half the dissolved inorganic nitrogen brought into the marsh by groundwater is converted to and exported as PN, a form suitable for consumers. PC exported to coastal water is equivalent to 40% of the net annual production of Spartina alterniflora, the dominant marsh plant. (Howard-Mass)
W80-03532

THE CONTRIBUTION OF MACROPHYTES TO THE METALIMNETIC OXYGEN MAXI-MUM IN A MONTANE, OLIGOTROPHIC LAKE,
Virginia Univ., Charlottesville. Dept. of Biology.
C. I. Dubay, and G. M. Simmons, Jr.
American Midland Naturalist, Vol 101, No 1, p 108-117, 1979. 5 Fig, 2 Tab, 29 Ref.

Descriptors: *Lakes, *Rooted aquatic plants, *Dis-solved oxygen, Virginia, Aquatic plants, Oxygen, Ecology, Stratification, Hypolimnion, Distribution patterns, Ecological effects, Standing crop.

Dense beds of rooted macrophytes, primarily Ni-tella flexilis, grow around the circumference of the lake to a depth of 11 m. There was no correlation between the positive heterograde oxygen curve and limnetic phytoplankton density or estimates of primary productivity. The strongest association ex-isted between the metalimnetic oxygen maximum and the standing crop dry weights of the macro-phyte community. All transects across the macro-phyte beds indicated the greatest standing crop to be between depths of 6 to 10 m. Variation in total standing crop between transects is attributed to slope angle of the basin, substrate, and direction of slope, in order of importance. (Steiner-Mass)
W80-03533

EFFECTS OF OFF-ROAD VEHICLES ON PLANTS OF A NORTHERN MARSH,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 4C.
W80-03536

VEGETATION ZONATION AROUND FRESH-WATER SPRINGS OF THE MAHARLU SALT LAKE NEAR SHIRAZ (IRAN), VEGETATIONSZONIERUNG AN SUSSWAS-SERQUELLEN DES MAHARLUSALZSEES BEI SHIRAZ (IRAN),
Tuebingen Univ. (Germany, F.R.). Lehrbereich fuer Spexielle Botanik.
W. Frey, and W. Probst.
Vegetatio, Vol 29, No 2, p 109-114, November 25, 1974. 5 Fig, 12 Ref. (English summary).

Descriptors: *Salt marshes, *Aquatic plants, *Eco-logical distribution, *Saline lakes, *Salt tolerance, Ecology, Spatial distribution, Wetlands, Marshes, Iran.

Spatial distribution of vegetation types around three freshwater sources of the salt lake Maharlu in S. Iran is a function of decreasing salinity within the delta-like area between the lake border and the sources. Juncus maritimus dominates on the saline soils of the lake shore. This species is replaced by Aeluropus lagopoides on soils influenced by fresh-water. Freshwater species such as Potamogeton pusillus and Spirogyra fluviatilus establish near the sources. Between the drainage streams of the sources and the shoreline, Cyperus laevigatus dominates. Within this zone three subzones can be distinguished. Species like Spirogyra fluviatilus are found nearest the source with a compact mat of Chara tomentosa occurring farther away. The third subzone, which consists of Cyperus laeviga-tus with Mougeotia cf. crassa and blue algae, pre-cedes the final Salicornia zone, dominated by Sali-cornia europaea and Spergularia marina. (Howard-Mass)
W80-03537

TRICKLE IRRIGATION TIMING AND ITS EFFECT ON PLANT AND SOIL WATER STATUS,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
For primary bibliographic entry see Field 3F.
W80-03545

ARID LANDS BIOMASS PRODUCTION IN ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Stud-ies.
K. E. Foster.
Arizona Water Resources Project Information, Project Bulletin No 22, Dec 1979. 3 p, 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Tumbleweed, *Crop production, *Alternative planning, *Efficiencies, *Fuels, Eco-nomic fesibility, Biomass, Consumptive use, Energy conversion, Water conservation, Environ-mental effects, Arizona.

Although more than 3 million hectares (ha) of land in Arizona are available for crop production, only slightly more than 0.5 million ha are farmed each year due to the absence of dependable and inexpen-sive water supplies. An alternative for Arizona's agricultural economy is to cultivate crops that grow naturally in arid and semiarid climates, for example the common Russian thistle or tumbleweed (Salsola kali) which has very high water-use to biomass-produced efficiencies. Al-though cultivation of tumbleweed, a high energy content plant suitable for biomass-derived fuels, involves considerable amounts of land, it appears that water conservation, energy, economic, and environmental gains are greater than the costs, particularly since retired agricultural lands are available for economic use, and agriculture could be restored to those communities where it has been the prime source of revenue but has been declining due to lack of inexpensive water. (Tickes-Arizona)
W80-03546

2J. Erosion and Sedimentation

TRACE ELEMENT RELEASE FROM ESTUAR-INE SEDIMENTS OF SOUTH MOSQUITO LAGOON NEAR KENNEDY SPACE CENTER,
Savannah State Coll., GA.
For primary bibliographic entry see Field 5A.
W80-03355

TRACER STUDY OF SEDIMENT-WATER IN-TERACTIONS IN ESTUARIES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
N. A. Luedtke, and M. L. Bender.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 643-651, November 1979. 5 Fig, 4 Tab, 14 Ref.

Descriptors: *Sediments, *Estuaries, *Sediment-water interfaces, *Tracers, Isotope studies, Radioi-sotopes, Pore water, Earth-water interfaces, Benthic fauna, On-site investigations, Sampling, Model studies, Mathematical models, Sedimento-logy, Biology, *Narragansett Bay(RI), Sediment-water interactions, Water exchange.

Rates of sediment bioturbation and advective ex-change of water across the sediment-water inter-face in Narragansett Bay, Rhode Island, were stud-ied by radioactive tracer experiments. The 'biologi-cal pumping rate' of water across the interface (0.7 0.3 cu cm/sq cm/day) was calculated from a two box model in which the decrease in 22Na concen-tration in water overlying a box core was ascribed to animal pumping of water across the sediment-water interface. The 'diffusion coefficient' of solid sediment was determined to be 3 1 x 10 to the minus 7th power sq cm/s from the depth distribu-tion at the end of the experiment of 141Ce tagged microspheres and 59Fe (which was quantitatively scavenged onto particles at the start of the experi-ment). The pore water profile determined for 54Mn in the cores was similar to stable Mn profiles previously determined for the site. Of the radioiso-topes added to the water overlying the box core, nearly 100% of the Na and 50% of Sr remained in solution, while only 10% of the Ba, Mn, and Hg and less than 1% of the Cd, Zn, and Fe remained in solution when the experiments were terminated. (Sims-ISWS)
W80-03368

MINOR ELEMENTS IN THE SEDIMENTS OF THE THAMES ESTUARY,
Thames Water Authority, London (England). Di-rectorate of Scientific Services.
L. A. Nelson.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 623-629, November 1979. 3 Fig, 4 Tab, 13 Ref.

Descriptors: *Trace elements, *Sediments, *Sus-pended solids, *Estuaries, Sampling, Chemical analysis, Neutron activation analysis, Heavy metals, Chemicals, Tidal waters, Coasts, Rivers, Sedimentation, Sedimentology, *England, *Thames Estuary(England), Resuspended sedi-ments.

Concentrations of Ce, Th, Cr, Hf, Cs, Sc, Fe, Co, and Eu were determined in the suspended particu-

late matter and sediments of the Sea Reach area of the Thames Estuary using instrumental neutron activation analysis. Element-scandium relationships in the materials indicated a difference in composition of the suspended matter to the sediment, and it was suggested that the suspended matter represents resuspended fine grained detrital sediment. The observed hafnium enrichment in the sediment was discussed in relation to this. (Sims-ISWS)
W80-03370

SEASONAL SHIFTS OF SEDIMENT WITHIN AN ESTUARY MEDIATED BY ALGAL GROWTH,
Birkbeck Coll., London (England). Dept. of Geology.
L. E. Frostick, and I. N. McCave.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 569-576, November 1979. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Mudflats, *Estuaries, *Algae, *Sediments, Coasts, Deposition(Sediments), Erosion, Euglenophyta, Biology, Effects, Sedimentation, Sedimentology, *England, *East Anglia(England).

Measurements of the level of mud flats in the Deben estuary (Suffolk, England) show seasonal change with accretion of about 5 cm between April and September during algal growth, and erosion of that amount during autumn and winter when algae are dead or absent. Although some seasonal change might occur in the absence of algae, the rates of deposition involved require that erosion be inhibited and sedimentation be maximized from the available suspensions. In this, the binding and baffling activity of algae was apparent. The total amount of deposition on the flats (100,000 tons) was far more than can be supplied from the river or the sea, and transfer between the channel banks and the tidal flats on a seasonal basis was postulated. (Sims-ISWS)
W80-03374

THE DETERMINATION OF ESTUARINE SEDIMENTATION RATES BY 134CS/137CS AND OTHER ARTIFICIAL RADIONUCLIDE PROFILES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
S. R. Aston, and D. A. Stanners.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 529-541, November 1979. 4 Fig, 5 Tab, 41 Ref.

Descriptors: *Sedimentation rates, *Estuaries, *Isotope studies, *Radioisotopes, Profiles, Sediments, Sedimentation, Radioactive dating, Sampling, Cores, Data processing, Sedimentology, *England.

The profiles of 137Cs, 134Cs, 106Ru, 144Ce, 95Zr/Nb, and the 134Cs/137Cs ratio in a sediment core and their discharge patterns from the Windscale Nuclear Plant were used to determine the net sedimentation rate on an estuarine intertidal bank. The use of multiradionuclide and 134Cs/137Cs ratio profiles suggested that previous single radionuclide profiles which have been used for sedimentation rate determinations may be subject to errors. Apparent diffusion coefficients were used in a modification of Lerman's model to correct the input pattern of the radionuclides for postdepositional migration. A comparison of the corrected profiles with the observed profiles suggested that the vertical distribution of radionuclides is not significantly altered after deposition and closely relates to the discharge pattern. The multiradionuclide discharge patterns and sediment profiles indicated that the net sedimentation rate is in the range 50-80 mm/year, while the 134Cs/137Cs ratio data gave a more reliable estimate of 67 mm/year. (Sims-ISWS)
W80-03377

A PREDICTIVE MODEL OF SEDIMENT TRANSPORT IN LAKE MICHIGAN BASED UPON CLAY MINERALOGY,
Michigan State Univ., East Lansing. Dept. of Natural Science.
G. P. Merk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147275, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, January 1980. 14 p, 1 Fig, 3 Tab, 4 Ref. OWRT A-093-MICH(1).

Descriptors: *Lake Michigan, *Clay minerals, *Sediment transport, *Water pollution sources, Sediments, Illite, Kaolinite, Particle size, Suspended solids, Deposition(Sediments), Bottom sampling, Laboratory tests, Soil analysis, Assay.

Clay minerals present in the sediments of rivers emptying into southern Lake Michigan and those present in the surficial sediment of southern Lake Michigan (Waukegan Member) were studied to develop a model of sediment transport for that area of the lake. It appears that man-made pollutants from areas around the lake are being concentrated in the clays and sediment of this area. Rivers sampled include the St. Joseph, the Black, the Kalamazoo, the Grand, and the Muskegon. Each river was sampled three times using a depth integrating water sample to collect about 15 gallons per sample. The samples were treated in the laboratory to identify the various clay minerals which included illite, kaolinite, chlorite, and vermiculite. Peak height values were also calculated from x-ray diffractograms of the clay fraction of the samples and were used to develop the geographic pattern of clay mineral variations in the rivers. Samples from six locations in the Waukegan Member were also analyzed in the laboratory and diffractograms were made. Comparisons of clay mineral peak height ratios on the diffractograms do not show any pattern of lateral variation between the six stations sampled. Also the ranking order of clay minerals found for the Waukegan Member are consistent for the stations sampled. This uniformity and the existence of sand at all sites suggests a lakewide current system producing much sediment dispersion, mixing, and resuspension. (Seigler-IPA)
W80-03382

METHOD MEANS FOR DE-SILTING WATER,
For primary bibliographic entry see Field 5G.
W80-03410

AGGRADATION IN STREAMS DUE TO OVER-LOADING,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
J. P. Soni, R. J. Garde, and K. G. Ranga Raju.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15147, p 117-132, January 1980. 12 Fig, 14 Ref, 2 Append.

Descriptors: *Alluvial channels, *Aggradation, *Mathematical models, Hydraulics, River beds, Sediment transport, Rivers, Sedimentation, Sediment load, Equations, Streams, Flumes, Flow, *Stream overloading, Sediment characteristics.

The problem of aggradation due to increase in the rate of sediment supply in excess of what the stream can carry has been investigated. The supply of sediment is assumed to be continuous and at a constant rate. A relationship for the depth of aggradation at any time and at any distance from the section of sediment addition has been developed. Since the mathematical model used was based on many simplifying assumptions, it needed verification against a known set of data. Experiments were, therefore, performed in the laboratory, and these have enabled suitable modification of the analytical results. (Lee-ISWS)
W80-03452

EFFECTS OF OFF-ROAD VEHICLES ON THE SEDIMENTS OF HATCHES HARBOR, CAPE COD NATIONAL SEASHORE,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 4C.
W80-03535

2K. Chemical Processes

GEOLOGY AND GEOCHEMISTRY OF THE SHIP CREEK AND MONASHKA CREEK RESERVOIRS, SOUTHCENTRAL ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. B. Hawkins, and G. L. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143654, Price codes: A05 in paper copy, A01 in microfiche. Report No IWR-71, 1976. 70 p, 12 Fig, 8 Tab, 16 Ref, 8 Append, OWRT A-045-ALAS (1), 14-31-0001-5002.

Descriptors: *Hydrogeology, *Geochemistry, *Water chemistry, *Alaska, Streams, Water quality, Soil chemistry, Solubility, Leaching, Soluble rocks, Graywacke, *Ship Creek(Alaska), *Monashka(Alaska).

Graywacke from the Ship Creek watershed dissolves incongruently in distilled water. The dissolution appears to follow a first-order rate law, which is developed along with experimentally derived rate constants for this dissolution. A surface area correction term must be inserted in this equation if it is applied to a different size fraction. Using equation and rate constants, the chemical composition of a water in contact with graywacke was calculated. With the exception of magnesium, there was good agreement between the calculated composition and that of Ship Creek water. Assuming that the groundwater in the Ship Creek watershed contacts about 1500 cc graywacke per liter, 120 to 360 days are required at 5C to produce the concentration of ions observed in Ship Creek. Release of exchangeable hydrogen ions from the soil to the reservoir water will not significantly lower the pH of the water. Leaching of heavy metals from sulfides contained in the bedrock of the two watersheds does not pose a water quality hazard. Lineaments in the bedrock at Monaska Creek may provide channels through which water may seep from the reservoir. These are not expected to pose a problem in retaining water in the reservoir, but these may result in small, new springs down grade from the reservoir. (Paulson-Alaska)
W80-03304

MODIFIED AMPEROMETRIC MEMBRANE PROBES FOR DETERMINING FREE AND TOTAL RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Research Labs.
For primary bibliographic entry see Field 5A.
W80-03462

2L. Estuaries

ON MAN-INDUCED VARIATIONS IN THE CIRCULATION OF THE MEDITERRANEAN SEA,
Miami Univ., FL.; and National Oceanic and Atmospheric Administration, Miami, FL.; and Cooperative Inst. for Marine and Atmospheric Studies, Miami, FL.
D. Nof.
Tellus, Vol 31, No 6, p 558-564, December 1979. 2 Fig, 13 Ref. NSF ATM-28126, ATM75-22940.

Descriptors: *Circulation, *Water circulation, *Salinity, *Diversion, Rivers, Runoff, Mixing, Evaporation, Inflow, Model studies, Mathematical models, Oceanography, *Mediterranean Sea, *Straits of Gibraltar, *Nile River, River diversion.

The response of the Mediterranean Sea to a diversion of rivers, such as the Nile, for agricultural use, was investigated by a simplified dynamical model for the Mediterranean basin. Solutions were obtained by using the principle of 'hydraulic control' at the Straits of Gibraltar, volume and salinity conservations, and perturbation techniques. It was found that such a diversion causes an increase of salinity in the basin and alters the exchange between the Mediterranean Sea and the Atlantic Ocean. The predicted result was an increase in the transport through the Straits of Gibraltar. This

ncrease of both the transport into and from the Mediterranean is about eight times larger than the mount of water which is diverted and is expected o take place within 25-50 years after the diversion. or the Nile alone, which has been diverted in the id-1960s, an increase of approximately 0.5% in ie transport through the Gibraltar Straits will ccur, and if all runoff flowing into the Mediterra-ean Sea was to be diverted, an increase of ap-roximately 3.5% will take place. (Sims-ISWS) V80-03354

RACE ELEMENT RELEASE FROM ESTUAR-NE SEDIMENTS OF SOUTH MOSQUITO AGOON NEAR KENNEDY SPACE CENTER,
avannah State Coll., GA.
or primary bibliographic entry see Field 5A.
V80-03355

YPSOMETRY OF THE CONTINENTAL HELF OFF EASTERN NORTH AMERICA,
Voods Hole Oceanographic Institution, MA.
. O. Emery.
stuarine and Coastal Marine Science, Vol 9, No p 653-658, November 1979. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Hypsometric analysis, *Continental helf, *Atlantic Ocean, *Gulf of Mexico, *North merica, Bathymetry, Oceans, Coasts, Sediments, rosion, Continental slope, Geomorphology, larine geology, *Eastern U.S., Depth zones, Vater masses.

reas measured between contours at 20-m inter-als on most of the continental shelf off eastern lorth America were used to construct histograms nd cumulative curves of areas of bottom and olumes of overlying water at various depths. The rgest and deepest (212-m to 93-m median depths) helf provinces are those that have undergone gla-ial erosion; these have most of the overlying vater. More typical of continental shelves of the vorld are those floored by thick sediments; they ave median depths between 27 and 40 m and most re broadly convex in profile between the shore nd the shelf break. Also convex upward are the elt between the shore and the -100-m contours nd the belt between -20 m and 20 m above sea evel. However, the belt between the 20-m and 00-m contours and the broader one between the -00-m and 100-m contours are concave upward. his geometry is about what would be expected om the known history of marine erosion and eposition on a relatively submergent coast. (Sims-SWS)
V80-03367

RACER STUDY OF SEDIMENT-WATER IN-ERACTIONS IN ESTUARIES,
hode Island Univ., Kingston. Graduate School of Oceanography.
or primary bibliographic entry see Field 2J.
V80-03368

ACTORS INFLUENCING WATER MOVE-IENTS IN THE FIRTH OF CLYDE,
Marine Lab., Aberdeen (Scotland).
. D. Dooley.
Estuarine and Coastal Marine Science, Vol 9, No p 631-641, November 1979. 9 Fig, 1 Tab, 7 Ref.

Descriptors: *Circulation, *Currents(Water), *Estuaries, Water circulation, Current meters, Measurement, Coasts, Tidal waters, Winds, Temperature, Water temperature, Salinity, Density, Transmissivity, Chlorophyll, Sampling, Oceanography, Scotland, *Firth of Clyde(Scotland).

n the period 1972-1974, 530 days of current obser-ations were obtained in the Firth of Clyde, on the vest coast of Scotland. In addition, hydrographic urveys were conducted at frequent intervals from vhich geostrophic currents were calculated. Tidal treams in the area were low (less than 10 cm/s), nd because of the resulting low levels of turbu-ence and mixing, the water structure was patchy vith relatively large horizontal and vertical densi-y gradients. Many of the fluctuations in velocity vere due to advection of the patches which were in geostrophic balance. In addition, there were wind-driven flows which occasionally caused rapid renewal of the water in the Firth of Clyde. The wind/current relationship was complex, however, and appeared dependent on the existing density distribution. (Sims-ISWS)
W80-03369

MINOR ELEMENTS IN THE SEDIMENTS OF THE THAMES ESTUARY,
Thames Water Authority, London (England). Directorate of Scientific Services.
For primary bibliographic entry see Field 2J.
W80-03370

PHYTOPLANKTON PRODUCTION IN A TURBID, TEMPERATE SALT MARSH ESTUARY,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner, S. W. Woo, and H. R. Jitts.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 603-613, November 1979. 5 Fig, 3 Tab, 33 Ref.

Descriptors: *Phytoplankton, *Estuaries, *Salt marshes, *Georgia, Plankton, Primary productivity, Aquatic productivity, Coasts, Tidal waters, Wetlands, Marshes, Sampling, Light, Temperature, Water temperature, Storms, Biology, *Wassaw Sound(GA).

Maximum rates of particulate formation (P sub max) by phytoplankton in the Wassaw Sound estuary (Georgia, U.S.) average 20.2 mg C/cu m/h. Annual primary production is about 90 g C/sq m. The point at which plankton photosynthesis is saturated with light (I sub k) is lowest during winter. Short term temperature fluctuations cause a shift in I sub k paralleling the seasonal relationship of I sub k vs. temperature. Seasonal changes in P sub max are also closely related to temperature in the estuary. Temporal and spatial variation of both P sub max and light attenuation is considerable. The marsh appears to be a net consumer of photosynthetically active phytoplankton cells. Estuarine flushing by storms and rivers spills the accumulated estuarine phytoplankton into the nearshore zone where the much more favorable light conditions lead to a dramatic increase in production per sq m. (Sims-ISWS)
W80-03372

A COMPARISON OF THE AXIAL DISTRIBUTIONS OF SALT AND 137CS IN THE SEVERN ESTUARY DURING AUGUST 1974,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5B.
W80-03373

SEASONAL SHIFTS OF SEDIMENT WITHIN AN ESTUARY MEDIATED BY ALGAL GROWTH,
Birkbeck Coll., London (England). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-03374

COASTAL COLLOIDAL CARBON: A STUDY OF ITS SEASONAL VARIATION AND THE POSSIBILITY OF RIVER INPUT,
Duke Univ., Beaufort, NC. Marine Lab.
A. Zsolnay.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 559-567, November 1979. 6 Fig, 3 Tab, 18 Ref. ONR N00014-78-C-0294.

Descriptors: *Carbon, *Colloids, *Sea water, *Atlantic Ocean, *North Carolina, Coasts, Sampling, Monitoring, Organic matter, Rivers, Seasonal, Variability, Analytical techniques, Chromatography, Oceanography, Pyrolysis.

The concentration of organic colloidal and nonparticulate carbon was monitored for one year off the coast of North Carolina. The mean value for colloidal carbon was 148 25.0 micrograms/liter. No seasonal pattern was apparent. Furthermore, the amount of colloidal carbon appeared to be independent of the amount of nonparticulate carbon. On an average, 11 2.0% of the nonparticulate carbon was colloidal. A strong negative correlation between colloidal carbon concentrations and salinity was found, indicating that the bulk of the colloidal material in rivers does not reach the coast. 'Fingerprints' obtained with pyrolysis-gas liquid chromatography show that coastal and river/estuarine colloidal material are composed of different compounds. Coastal colloidal material had no significant fluorescence or light absorption in the ultraviolet and visible range, indicating that it is poor in aromatics and other chromophores. Therefore, it is not composed of gelbstoff. (Sims-ISWS)
W80-03375

COMMUNITY STRUCTURE AND SEASONAL VARIATION IN INTERTIDAL PANAMANIAN SANDY BEACHES,
San Diego State Univ., CA. Center for Marine Studies.
D. M. Dexter.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 543-558, November 1979. 5 Tab, 47 Ref.

Descriptors: *Beaches, *Biological communities, *Benthic fauna, *Pacific Ocean, Sampling, On-site investigations, Intertidal areas, Coasts, Tropical regions, Biomass, Density, Biology, *Panama, *Caribbean Sea.

Two Panamanian sandy beaches, one along each coast, were examined in 1973-1974 as a continuation of preliminary sampling in 1969-1970. Infaunal community structure for each beach was described in terms of species composition, density, biomass, diversity, and evenness. The influence of environmental factors on the zonation and abundance of the dominant species was discussed. The Caribbean beach was exposed to a marked wet vs. dry season, while the major environmental feature of the Pacific beach is a strong upwelling of cool water during the dry season. Community structure of the Caribbean beach was characterized by lower density, fewer species, higher diversity, and greater fluctuation among faunal dominants. The Pacific beach fauna had higher density, greater number of species, and lower diversity due to the dominance by the isopod Excirolana braziliensis. Explanations for the major differences in community structure between the two beaches were presented. (Sims-ISWS)
W80-03376

THE DETERMINATION OF ESTUARINE SEDIMENTATION RATES BY 134CS/137CS AND OTHER ARTIFICIAL RADIONUCLIDE PROFILES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W80-03377

SALT MARSHES AND SALT DESERTS OF THE WORLD,
Auckland Univ. (New Zealand). Dept. of Botany.
V. J. Chapman.
In: Ecology of Halophytes, Reimold, R. J., and Queen, W. H. (eads.), Academic Press, Inc., New York. p 3-19, 1974. 1 Fig, 112 Ref.

Descriptors: *Salt marshes, *Deserts, *Geographical regions, Wetlands, Marshes, Marsh plants, Distribution patterns, Halophytes, Desert plants, Saline soils.

One characteristic of salt marshes and salt deserts is provided by the fact that only a relatively small number of plant species are capable of tolerating the degrees of salinity that occur. As a result, there are broad geographical areas in which there is a substantial uniformity in the vegetation. In some cases, subdivision can be based on temperatures or upon soil type. The dominant vegetation of maritime salt marshes is essentially phanerogamic herbs, though some shrubs also occur. Inland salt marshes, and especially salt deserts, are typified by shrubs. Apart from the phanerogams, maritime salt

marshes also carry an extensive algal vegetation which may, in places, be as important as the phanerogams. (Steiner-Mass)
W80-03504

PRODUCTION AND STRUCTURE IN THE EARLY STAGES OF VEGETATION DEVELOPMENT IN THE LAUWERSZEE-POLDER,
Groningen Rijksuniversiteit (Netherlands). Afdeling Plantenoecologie.
W. Joenje.
Vegetatio, Vol 29, No 2, p 101-108, November 25, 1974. 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Estuarine environment, *Vegetation establishment, *Halophytes, *Succession, *Productivity, *Embankments, Mud flats, Wetlands, Ecological distribution, Saline soils, Salt tolerance, *Netherlands.

During the first growing season after embankment of the Lauwerszee estuary, there was a rapid increase in biomass and appearance of many species on quickly desalinating areas, and a slow colonization by only a few species and low productivity on areas with impeded desalination. The halophytic pioneer vegetation consisted almost completely of Salicornia spp., Sugeda maritima, Atriplex hastata, and Spartina x townsendii. In the initial stage after embankment, plant densities were determined by the available amount of seeds, while after three years the total number and biomass was limited by environmental factors, especially those affecting soil fertility. The low productivity of the polder communities probably results from low fertility that limits the growth of the halophytes (which are used to a relatively rich supply of nutrients), and the salinity and delays in dispersal that exclude other species. (Howard-Mass)
W80-03524

TIDELANDS AND THE PUBLIC TRUST: AN APPLICATION FOR SOUTH CAROLINA,
For primary bibliographic entry see Field 6E.
W80-03526

EFFECTS OF OFF-ROAD VEHICLES ON THE SEDIMENTS OF HATCHES HARBOR, CAPE COD NATIONAL SEASHORE,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 4C.
W80-03535

EFFECTS OF OFF-ROAD VEHICLES ON PLANTS OF A NORTHERN MARSH,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 4C.
W80-03536

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, SALT POND NO. 3 MARSH DEVELOPMENT SITE, SOUTH SAN FRANCISCO BAY, CALIFORNIA; SUMMARY REPORT,
San Francisco Bay Marine Research Center, Inc., Richmond, CA.
For primary bibliographic entry see Field 4A.
W80-03555

NUMERICAL SIMULATION OF THE COOS BAY-SOUTH SLOUGH COMPLEX,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
H. L. Butler.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 698, Price codes: A07 in paper copy, A01 in microfiche. Technical Report H-78-22, December 1978. 123 p, 1 Tab, 8 Ref, 1 Append, 90 Pl.

Descriptors: *Estuaries, *Bays, *Inlets(Waterways), *Mathematical models, Simulation analysis, *Numerical simulation, *Tidal inlets, *Coos Bay(Ore).

Coos Bay Inlet, on the south central coast of Oregon, provides tidal flow to two estuary systems: Coos River to the north and South Slough to the south. Charleston Harbor is located at the entrance into South Slough and is affected by continual shoaling problems within the harbor entrance channel. A two-dimensional numerical tidal model (WIFM) was used to investigate the tidal hydrodynamics of the inlet complex. The complex geometry of the Coos Bay area made it necessary to develop a capability of computing the tidal regime on a variable grid system. This study applies WIFM to the Coos Bay-South Slough complex to predict quantitatively the hydrodynamics (exclusive of sediment transport and wave action) of the tidal flow in the system and compare existing conditions and alternate improvement plans. The improvement plans provide for: 1. Construction of specified navigation channels; 2. Alternate breakwater extensions west of the entrance channel; 3. Alternate detached groins east of the entrance channel. Five alternate plans were tested, and the results show that the introduction of any of the improvement plans as proposed would not produce any detrimental impact to tidal circulation in South Slough. (WES)
W80-03559

MOVEMENT OF SUSPENDED PARTICLES AND SOLUTE CONCENTRATIONS WITH INFLOW AND TIDAL ACTION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
A. N. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as N73-25358, Price codes: A02 in paper copy, A01 in microfiche. Technical Report M-78-2, August 1978. 170 p, 19 Fig, 6 Tab, 16 Ref, 3 Append.

Descriptors: *Suspended load, *Solutes, *Data collections, *Inflow, Tides, Chesapeake Bay, Movement, Suspended solids, Tidal effects, Salinity, *Spectrum analysis.

Landsat (formerly called ERTS-1) data recorded on computer-compatible tapes (CCT's) augmented by data derived from ground control measurements were used to determine the feasibility of detecting alterations to the optical properties of water caused by the movement of suspended particles and solutes in selected portions of the Chesapeake Bay area. Techniques were developed to process CCT's on a PDP-15 computer, establish correlations of radiance and suspended material concentrations, and produce suspended material distribution photomaps. This report discusses these techniques, and includes in appendixes a discussion of experience with automated data collection systems in connection with this study, validation of the computer algorithms for high suspended material concentrations, and by-products that resulted from this study. (WES)
W80-03564

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PROCESS DESIGN OF A 100,000 GALLON PER DAY VACUUM FREEZING EJECTOR ABSORPTION PILOT PLANT,
Chicago Bridge and Iron Co., Plainfield, IL.
V. F. Allo, T. R. Carbery, D. C. Cutler, G. E. Engdahl, and J. A. Nail.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144017, Price codes: A07 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December 1979. 111 p, Append, OWRT C-90058-D (9512) (1), 14-34-0001-9512.

Descriptors: *Desalination, *Desalination freezing process, Vacuum freezing, Ejector, Absorption, Design, Concept, Pilot plants, Cost analysis, Water desalting, Crystallization, Freezing.

A conceptual design study of the vacuum freezing ejector absorption (VFEA) process was completed and specifications were prepared for a nominal 100,000 gallon per day pilot plant. Included in the design are a process flow sheet, piping and instrumentation diagrams, equipment specifications, a computer program model, and preliminary engineering drawings. VFEA is a freeze desalination process in which water vapor from a vacuum freezer is compressed by a combination steam ejector and absorber loop. The absorption solution for this design is concentrated sodium hydroxide. Also included is an estimated budget cost to do the final engineering and to build the pilot plant.
W80-03301

DESALINIZATION AND CHEMICAL EXTRACTION PROCESS,
Desal-Chem, Inc., Tulsa, OK. (Assignee).
D. D. Childress.
U.S. Patent No 4,176,023, 6 p, 3 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1038, November 27, 1979.

Descriptors: *Patents, *Desalination, *Water purification, *Desalination processes, Water treatment, Desalination apparatus, Vapor compression distillation, Separation techniques, Waste, Electrolysis, Gases, Chlorine, By-products.

A combined desalinization and extraction process is described for brinewater having a salinity of 7 1/2% to 9%. The brinewater is introduced to a concentrator basically similar to a shell-and-tube type heat exchanger vertically arranged with upper and lower chambers above and below the tube section and communicating with each other through the tubes. A heating element in the lower chamber causes the brinewater to be heated until it reaches its boiling temperature. Vapors are removed from the upper chamber and are externally compressed so as to create a partial vacuum in the upper chamber. The compressed vapors are passed from the compressor to the concentrator into the spaces on the outside of the tubes where the vapors are condensed as liquid water. The condensed fresh water on the outside of the tubes is removed. The remaining brinewater within the tubes, which is concentrated at 28% salinity, is conducted to electrolytic cells having positively charged anodes and negatively charged cathodes. The concentrated brine is electrolyzed with low voltage direct current to release chlorine gas, caustic alkali containing primarily sodium hydroxide, hydrogen gas, and an inert material containing calcium, nitrogen, and magnesium oxide. The chlorine gas is conducted to a mist extractor separator to remove any impurities and then compressed to form liquid chlorine. The hydrogen gas is conducted to a mist extraction separator to remove any impurities. (Sinha-OEIS)
W80-03464

SOCIO-ECONOMIC CHANGES AND DEVELOPMENT OF WATER RESOURCES IN SAUDI ARABIA,
King Abdulaziz Univ. Jeddah (Saudi Arabia). Dept. of Biology.
For primary bibliographic entry see Field 6D.
W80-03502

THE ECONOMIC FEASIBILITY OF DUAL PURPOSE NUCLEAR DESALINATION OF GROUND WATER,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics.
R. R. Lansford, S. Ben-David, F. Roach, B. J. Creel, and T. H. Stevens.
Water Resources Bulletin, Vol 15, No 6, p 1589-1601, December, 1979. 2 Fig, 6 Tab, 11 Ref.

Descriptors: *Southwest U.S., *Desalination plants, *Economic feasibility, *Nuclear powerplants, Ground water, Brackish water, Freshwater, Heat transfer, Flash distillation, Reservoirs, Irrigation, Recreation, Brine disposal, Byproducts, Water transfer.

The economic feasibility of using a nuclear power facility for simultaneous energy production and desalination of brackish ground water was evaluated for the Southwestern United States. Other benefits to be derived from such a dual purpose facility

are mineral recovery using heat which is usually wasted in power production, water-based recreational opportunities, and irrigation storage. Two alternative project designs were developed. The first alternative considered all the possible project benefits mentioned above while the second alternative included transferring desalted water to two adjacent rivers instead of a reservoir. In the first alternative, the net benefits ranged from $-986.57 million at a 5% discount rate to $-1,137.528 million at a 10% discount rate. In the second alternative, net benefits ranged from $-382.527 million to $-478.612 million at the 5 and 10 percent discount rates. With the possible introduction of hot, dry rock geothermal energy, the cost of desalination may be reduced enough to make dual purpose nuclear desalination of ground water in the southwest economically feasible. (Purdin-NWWA)
W80-03544

3B. Water Yield Improvement

SOCIO-ECONOMIC CHANGES AND DEVELOPMENT OF WATER RESOURCES IN SAUDI ARABIA,
King Abdulaziz Univ. Jeddah (Saudi Arabia). Dept. of Biology.
For primary bibliographic entry see Field 6D.
W80-03502

THE ECONOMIC FEASIBILITY OF DUAL PURPOSE NUCLEAR DESALINATION OF GROUND WATER,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3A.
W80-03544

PERFORMANCE EVALUATION OF WATER HARVESTING CATCHMENTS,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
G. W. Frasier, K. R. Cooley, and J. R. Griggs.
Journal of Range Management, Vol 32, No 6, p 453-456, Nov 1979. 2 Fig, 3 Tab, 4 Ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Sprinkling, *Membranes, *Water yield improvement, Evaluation, Surface sealing, Infiltration, Surface runoff, Testing procedures.

A small portable sprinkler was used to estimate runoff efficiencies of various catchment treatments on 14 operational water harvesting systems at the Granite Reef Test Site in Arizona. This method, which is verified using actual rainfall-runoff data from test plots, indicates that the performance of a water harvesting system depends on the effectiveness of the catchment apron treatment to inhibit infiltration. Membrane treatments, like asphalt, fiberglass, and butyl, yielded 90-100% precipitation runoff while properly installed wax-type treatments yielded over 80% runoff. A gravel-covered polyethylene treatment was found to require a high threshhold rainfall quantity to overcome water retention within the gravel layer. It is hoped that this sprinkler method will permit evaluation of catchment runoff efficiencies without resorting to the time and effort required for large field-instrumentation projects. (Tickes-Arizona)
W80-03552

3C. Use Of Water Of Impaired Quality

WELL DRILLING FOR +250F WATER,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8A.
W80-03428

WASTEWATER HELPS THE BARLEY GROW,
Arizona Univ., Tucson. Dept. of Plant Sciences.
D. A. Day, J. A. McFadyen, T. C. Tucker, and C. B. Cluff.
Water and Wastes Engineering, Vol 16, No 8, p 26-28, August 1979. 4 Tab.

Descriptors: *Barley, *Water reuse, *Irrigation effects, *Crop response, Waste water disposal, Municipal wastes, Environmental effects, Plant growth, Soil properties, Hydrogen Ion concentration, Mixing.

The effects of treated municipal wastewater on crops, soils, and irrigation water were investigated in this study near Buckeye, Arizona, 1974-75, to compare (1) response of barley irrigated with a mixture of pump water and wastewater with the response to pump water alone, (2) the effect of pump water and pump water-wastewater irrigation on soil properties, and (3) quality of a pump water-wastewater mixture with that of pump water alone as a source of irrigation water for barley production. Effects of the two treatments were studied on 'Arivat' barley fields set in a modified randomized complete block experimental design with four replications in a predominantly coarse loam soil. Results indicate that barley grown with the mixture was superior in growth, grain yield and quality to that irrigated with pump water alone, while the soil under both types of irrigation had similar pH at the end of the study. Conclusions indicated that treated municipal wastewater can be used as a partial source of irrigation water and plant nutrients in the commercial production of barley in the irrigated areas of the arid southwest U.S. as well as in other similar climatic regions throughout the world. (Tickes-Arizona)
W80-03547

3E. Conservation In Industry

PROCESS FOR THE SEPARATION OF FOAM FROM EFFLUENTS OF COKE OVEN PLANTS,
United States Steel Corp., Pittsburgh, PA. (Assignee).
L. K. Husher, H. Weber, and K. Tippmer.
US Patent No 4,176,062, 6 p, 2 Fig, 1 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1050-1051, November 27, 1979.

Descriptors: *Patents, *Separation techniques, *Foam separation, Industrial wastes, Recycling, Water reuse, Coals, Coke oven plants, Tars.

A process is provided for the separation of suspensions and foam from the tar, ammonia liquor and condensate mixture obtained when coking finely ground pre-dried or preheated coal without considerable additional expenditures and consumption of energy and chemicals. A tap phase and a liquid phase are obtained so that the liquid phase can be recycled to the collection main and can be used, problem-free for the cooling of the hot gases produced when coking the coal and surplus liquor can be further processed. The mixture consisting of tar, ammonia liquor and condensate is freed from coarse particles in a primary decanter with concomitant development of a surface suspension and foam of 'swimming tar'. The suspension and foam floating on the surface of the ammonia liquor in the primary decanter is removed by traveling mechanical skimmers, delivered to a foam separator, and permitted to reside in the foam separator for at least two hours to effect separation of a water phase. The water phase is removed from the foam separator and recycled to the primary decanter. (Sinha-OEIS)
W80-03331

ANTI-CORROSION COMPOSITION FOR USE IN AQUEOUS SYSTEMS,
Quatic Chemicals Ltd., Guelph (Ontario). (Assignee).
For primary bibliographic entry see Field 5G.
W80-03409

INDUSTRIAL WATER ALLOCATION AND CONSERVATION IN CALIFORNIA.
California State Dept. of Water Resources, Sacramento. Office of Emergency Services.
A Compendium of Information for Industrial Water Managers Compiled from Proceedings of the Drought Conference on Industrial Water Allocation and Conservation, January 1978. 148 p.

Descriptors: *California, *Industrial water, *Water allocation(Policy), *Water demand, *Water conservation, Droughts, Industry, Water resources, Water supply, Water consumption, Water policy, Water utilization, Conservation, Water, Water distribution, Planning.

This is a compilation of proceedings of the Drought Conference on Industrial Water Allocation and Conservation held in Concord and Los Angeles (CA) during July 1977. Industrial water use is California's third and smallest sector of water use but the problem of water conservation was recognized even prior to the drought which California was experiencing at the time of this conference. Industry has the best record in conservation as compared to other water use sectors. In California 56% of the industrial water use comes from purveyors (water agencies) and about 44% is self-produced; this includes well water and water taken from rivers. Some short-range plans for industrial conservation include: (1) electrostatic water treatment for cooling towers; (2) re-use of overflow water; (3) recycled water from conductivity transducers; (4) used spray booth recycled water for bearing water makeup at sludge farm pumps; (5) outside water test controls; (6) time rinse sections of washers; and (7) automatic blow down controls for boilers. The potential savings for each of these plans range from 3,500 gallons per day to 46,000 gallons per day. Long-range water conservation plans include the recycling of car wash water and recycling water for wet sand facilities. The report includes discussions of the statewide response to the 1976-1977 drought, future water supplies and the third year of the drought, industrial water supplies for northern and southern California, local agency responses to the drought, specific industrial conservation programs and techniques, and methods of financing water conservation. (Iervolino-NC)
W80-03597

3F. Conservation In Agriculture

PHREATOPHYTE EVAPOTRANSPIRATION AND ITS POTENTIAL REDUCTION WITHOUT ERADICATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2D.
W80-03442

USE OF ENVIRONMENTAL DATA IN ASSESSING THE QUALITY OF IRRIGATION WATER,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
For primary bibliographic entry see Field 5G.
W80-03471

DEVICE FOR AUTOMATIC, SELECTIVE WATERING OF PLANTS,
L. Richard.
U.S. Patent No 4,175,579, 7 p, 4 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 890, November 27, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Water distribution(Applied), Irrigation practices, Irrigation efficiency.

A device for automatically selectively watering plants in a predetermined order for predetermined times comprises a casing which is connected to a source of water under pressure. The device houses a turbine wheel arranged to be driven by the water and to drive a set of gears which form a speed reducer, the output shaft of which extends out of the casing and carries a number of cams spaced apart along the shaft and each arranged to operate a valve of the pilot-operated type. The valves are identical, juxtaposed in a straight line, and connected to pipes provided with watering nozzles. (Sinha-OEIS)
W80-03506

TRICKLE IRRIGATION TIMING AND ITS EFFECT ON PLANT AND SOIL WATER STATUS,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
J. Ben-Asher.
Agricultural Water Management, Vol 2, No 3, p 225-232, Nov 1979. 3 Fig, 4 Tab, 3 Ref.

Descriptors: *Timing, *Irrigation efficiency, *Water balance, *Percolation, *Trickle irrigation, Irrigation practices, Crop response, Dune sands, Soil-water-plant relationships.

The effect of trickle irrigation timing was tested with tomato plants on Sinai sand dunes to estimate the various components of water balance under different high-frequency irrigation regimes, and to propose recommendations for irrigation policy. Irrigations were applied during daytime hours for one field and a short time after sunset on a second field in the uniform coarse sandy soil on a coastal area of Nahal Sinai. Results indicate that daytime irrigation of soil with low water-holding capacity significantly increased yields, improved plant water potential, and improved water use efficiency. The author concludes that controlling deep percolation, the dominant component of the water balance under these conditions, requires the measurement of net radiation flux as input for managing the quantity of water to be applied. (Tickes-Arizona)
W80-03545

IRRIGATION MACHINE,
J. M. Arlemark.
U.S. Patent No 4,174,809, 14 p, 10 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 988, No 3, p 625, November 20, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

The invention relates to an irrigation machine with a hose reel, rotatably mounted on a wheeled frame for a withdrawable and rewindable hose. One end, fixed to the hose reel, is connectable via a coupling to a water supply source and the other end is connected to a sprinkler gun on a gun carriage or sled. The reel for the hose, which is compression resistant and consists of rigid hose material, is coupled to a driving motor designed as a water turbine. The motor is coupled into a conduit system from the water supply source to the sprinkler gun and the hose reel is mounted with its axis of rotation substantially horizontal. The water turbine is coupled into the conduit system via an adjustable flow divider in the form of a three-way valve with one inlet and two outlets, the water turbine being connected in between the two outlets. (Sinha-OEIS)
W80-03584

IRRIGATION SYSTEM,
Hitachi Chemical Co. Ltd., Tokyo (Japan). (Assignee).
S. Watanabe, and M. Metsugi.
U.S. Patent No 4,174,067, 4 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 988, No 2, p 365, November 13, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance, Drip irrigation, Compressed air.

An irrigation system comprises a source of pressurized water and passages for conducting the water from the source to individual irrigation spots. The passages include a plastic pipe having very small slip openings for continuously discharging water. A source of compressed air is connected to the passages and an operational control temporarily stops the supply of pressurized water while the compressed air is discharged through the small slip openings to clear them from clogging. (Sinha-OEIS)
W80-03595

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

LAND-USE AND UPLAND WATER RESOURCES IN BRITAIN--A STRATEGIC LOOK,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W80-03363

PERSPECTIVES FROM THREE YEARS EXPERIENCE OF REGIONAL WATER SERVICES IN THAMES WATER AUTHORITY,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 5G.
W80-03364

SUMMARY REPORT, SOUTHEAST CONFERENCE ON URBAN STORMWATER MANAGEMENT,
North Carolina Water Resources Inst., Raleigh.
D. H. Howells.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147564, Price codes: A05 in paper copy, A01 in microfiche. SE Water Resources, Vol 2, No 1, Fall 1979. Conference held April 10-11, 1979 at NC State U, Raleigh. 80 p, 35 Fig. Water Resources Research Institute, University of North Carolina. OWRT B-123-NC(5), 14-34-0001-9144.

Descriptors: *Storm water, *Storm runoff, *Urban runoff, Drainage programs, Water policy, Storage, Flood plain zoning, Flood plains, Erosion control, Sediment control, Water pollution control, Conferences, Southeast U.S., Government, Local governments, State governments.

State, local, and regional programs for urban stormwater management (SWM) in the southeastern U.S. are discussed. Drainage and detention, flood plain management, erosion and sedimentation control, and stormwater pollution control tend to be dealt with in each geographical area on an individual basis. Community implementation of a unified SWM program covering the four areas integrated with zoning and subdivision ordinances is suggested. Prototype water quality studies, urban drainage programs and ordinances, national policy, and conclusions and recommendations of the conference participants are presented. It is recommended that ordinances in general should be concerned with policy and budgetary matters, not engineering criteria, design standards, or administrative detail. More involvement of interest groups, public works agencies, and the public, greater information/technology diffusion, more commitment of state governments, and more local monitoring of programs are suggested. (Schaefer-IPA)
W80-03381

THE APPLICATION OF HYDROLOGIC MODELS TO SMALL WATERSHEDS HAVING MILD TOPOGRAPHY,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B.
W80-03469

THE IMMEDIATE EFFECTS OF DITCHING A SALTMARSH ON NESTING HERRING GULLS LARUS ARGENTATUS,
Livingston Coll., New Brunswick, NJ. Dept. of Biology.
J. Burger, and J. K. Shisler.
Biological Conservation, Vol 15, No 2, p 85-103, February, 1979. 8 Fig, 1 Tab, 53 Ref.

Descriptors: *Saltmarshes, *Gulls, *Nesting, *Ditches, *Drainage effects, Animal behavior, Birds, Life history studies, Habitat, Nesting cover, Marshes, Wetlands, Environmental effects, Breeding.

The number of pairs of herring gulls breeding on an island in Barnegat Bay, New Jersey, remained the same as in the previous year after ditching in March, before the start of the breeding season. The number of breeding pairs on two nearby islands which were not ditched increased by 46% and 90%. Breeding chronology was similar on all three areas, but birds nesting on spoil laid eggs a mean of 8 days later than non-spoil nesting birds. Behavioural observations on aggression and display rates indicated that birds on spoil behaved similarly to those in open grassy areas but differed from those nesting in the buses. Nest site selection, breeding densities, and breeding success were similar on all three islands. The differences noted were attributed to the appearance of the marsh. It was postulated that pairs having nested on the experimental island in the previous year continued to nest after the island was ditched and pairs searching for new territory colonized the nearby islands. The later nesting of pairs breeding on spoil is attributed to the need to defend their nest sites which were situated in areas used for display by unmated birds. (Howard-Mass)
W80-03520

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, SALT POND NO. 3 MARSH DEVELOPMENT SITE, SOUTH SAN FRANCISCO BAY, CALIFORNIA; SUMMARY REPORT,
San Francisco Bay Marine Research Center, Inc., Richmond, CA.
J. H. Morris, C. L. Newcombe, R. T. Huffman, and J. S. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A065 775, Price codes: A03 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Technical Report D-78-57, December 1978. 22 p, 3 Tab.

Descriptors: *Salt marshes, *Habitats, *Marsh plants, Planting management, Plant growth, Dredged material, Habitat development, Marsh development, *San Francisco Bay(Calif.), Spartina foliosa.

A study of marsh development on confined dredged material substrate in an abandoned salt pond in South San Francisco Bay demonstrated that a California cordgrass (Spartina foliosa) marsh can be established within 2 years. For successful marsh development, proper elevations and tidal flow must be provided. For the San Francisco Bay area, sprigs should be planted in early spring on low wave energy sites and at 0.5- to 1.0-m intervals within the lower two-thirds of the intertidal range. (WES)
W80-03555

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY -- APPLICATION OF THE STORM WATER MANAGEMENT MODEL, VOLUME I,
Espey, Huston and Associates, Inc., Austin, TX.
E. V. Diniz, and W. H. Espey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-121437, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-050c, July 1979. 181 p, 68 Fig, 42 Tab, 23 Ref, 5 Append. 802433.

Descriptors: *Mathematical models, *Runoff forecasting, *Urban runoff, *Texas, *Drainage systems, Watersheds(Basins), Hydrographs, Base flow, Infiltration, Rainfall-runoff relationships, Surface runoff, Paving, Water quality, Land use, Water pollution, Erosion.

The Storm Water Management Model (SWMM) was extensively modified and used to model runoff and water quality from natural drainage areas in the Woodlands, an ecologically planned community in Texas, and in the Hunting Bayou, an urbanized watershed near Houston, Texas. New subroutines were programmed to allow SWMM to model (1) separate sewer systems, (2) urbanization effects on baseflows, (3) performance and cost efficiency of natural drainage systems, (4) additional water quality parameters (chemical oxygen demand,

Kjeldahl nitrogen, nitrates, and phosphates), and (5) hydrologic effects of porous pavements. These additional user options provide more model versatility such as the modelling of storm periods separated by low or zero rainfall and the computation of baseflow recessions. Using the model hydrographs were developed for 14 storms at the study sites. Overall results show that SWMM can be a successful tool for the prediction of future urbanization effects, however, the model should be tested in other geographical areas and further developed or refined as additional data is collected. Model limitations are cited for areas with transient land use and areas where extremely high suspended solids concentrations are generated. New subroutine source code listings and revised input coding instructions are included. (Seigler-IPA)
W80-03565

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIV-APPENDIX M, FLOOD CONTROL.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 2E.
W80-03569

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME V-APPENDIX D, WATER SUPPLY AND WATER POLLUTION CONTROL.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 5G.
W80-03577

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME IV-APPENDIX C, HYDROLOGY.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 2E.
W80-03578

THE DEVELOPMENT AND SERVICING OF SPATIAL DATA MANAGEMENT TECHNIQUES IN THE CORPS OF ENGINEERS,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 6A.
W80-03588

FLOOD DAMAGE ASSESSMENTS USING SPATIAL DATA MANAGEMENT TECHNIQUES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 6A.
W80-03589

SPATIAL DATA ANALYSIS OF NONSTRUCTURAL MEASURES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
For primary bibliographic entry see Field 6A.
W80-03590

4B. Groundwater Management

SOUTH DAKOTA GROUND WATER AND THE ARTESIAN PRESSURE: IS THE USE OF WATER FOR DOMESTIC PURPOSES STILL THE HIGHEST USE.,
For primary bibliographic entry see Field 6E.
W80-03420

THE MANAGEMENT OF GROUND WATER SUPPLIES,
Ground Water Consultants Group, Edmonton (Alberta).
P. L. Hall.
Water & Sewage Works, Vol 125, No 10, p 54-55, October, 1978. 1 Fig.

Descriptors: *Water management(Applied), *Ground water resources, *Water supply, Aquifers, Water demand, Optimization, Planning, Computer models, Water wells, Well spacing, Efficiencies, Conjunctive use, Artificial recharge, Environmental effects, Pumping, Storage.

The objectives of ground water management are: (1) to meet water demands; (2) to optimize water resources and existing distribution systems; and (3) to develop long-range plans. The physical limitations of the aquifer must be accurately determined before a management plan can be formulated. Peak demands can be met by storage facilities or increased withdrawals. Many water-well fields and their associated storage-distribution systems are not working at maximum efficiency due to interference between closely-spaced wells, scaling of well screens, and corrosion. Evaluation of well-field performance is complex and requires analog or digital computer models. The main advantage of using models is that alternative well locations and pumping rates and schedules can be compared in a short time without the need for expensive, prolonged field tests. The results of modeling are only as good as the quality of the input data. The data should be set up under the supervision of an experienced hydrologist. Long range planning should consider the finite capacity of the aquifer, future demands, adverse environmental impacts, conjunctive use, and artificial recharge. (Purdin-NWWA)
W80-03435

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN CARSON COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W80-03451

4C. Effects On Water Of Man's Non-Water Activities

TESTING OF SEVERAL RUNOFF MODELS ON AN URBAN WATERSHED,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2A.
W80-03352

DEALING WITH SITE DISTURBANCES FROM HARVESTING AND SITE PREPARATION IN THE LOWER COASTAL PLAIN,
Southern Forest Experiment Station, Pineville, IA. Forest Insect Research.
E. Shoulders, and T. A. Terry.
In: Proceedings, Symposium on Principles of Maintaining Productivity on Prepared Sites, Mississippi State University, March 21-22, 1978, Sponsored by US Forest Service and Southern Region of the Association of State College and University Forest Res. Organizations, p 85-97, 1978. 44 Ref.

Descriptors: *Lumbering, *Forest management, *Coastal plains, Wetlands, Forests, Roads, Forestry, Soil water, Soil compaction, Soil management, Microenvironment.

Harvesting operations that are carried out when the soil is wet can seriously damage lower coastal plain sites by compacting, puddling, churning, and rutting the soil and by disrupting natural drainage so that excess water is trapped on the surface. Site productivity is substantially reduced unless measures are taken to repair the damage. Damage can be avoided by scheduling operations when the soil is strong enough to support the logging equipment. Preharvest site drainage lengthens the period when damage-free logging can be done. Confirming traffic to as few trails as possible limits the extent of the damage from wet weather logging. (Steiner-Mass)
W80-03503

DRAINAGE AND LARVICIDING FOR CONTROL OF A MALARIA FOCUS IN HAITI,
World Health Organization, Washington, DC. Malaria Eradication Dept.
D. J. Schliessmann, V. R. Joseph, M. Solis, and G. T. Carmichael.
Mosquito News, Vol 33, No 3, p 371-378, September, 1973. 3 Fig, 3 Tab.

Descriptors: *Salt marshes, *Mosquitoes, *Larvicides, *Public health, Construction, Drainage effects, Environmental effects, Wetlands, Habitat, Human diseases, Carriers, *Haiti.

Three outbreak of P. falciparum malaria with more than 1,500 cases were experienced by the Haiti malaria eradication program in a densely populated focus of 10,000 people in 27 months. The focus contributed more than 15 percent of the total cases reported in the country in contrast to less than 0.13 percent in similar time periods before and after the outbreaks. The outbreaks resulted from environmental and ecological changes brought about by the construction of a road and resettlement housing which obstructed the natural drainage of the salt marsh area and created extensive mosquito breeding habitats. It is likely that natural reductions in vector populations during the dry season contributed to limiting the duration of the three epidemics and probably accounts for the control of the first outbreak. Larviciding contributed to the control of the second epidemic. The third epidemic followed the suspension of larviciding which permitted a buildup of vector densities. Its control, and the prevention of malaria during 27 months following the outbreaks while malaria transmission in the country was increasing, is attributed to the combined effects of the drainage project and of the program of larviciding. (Howard-Mass)
W80-03505

IMPACTS OF COAL-FIRED POWER PLANTS ON FISH, WILDLIFE AND THEIR HABITATS,
Argonne National Lab., IL. Environmental Impact Studies.
A. J. Dvorak, B. G. Lewis, P. C. Chee, E. H. Dettmann, and R. F. Freeman, III.
U.S. Fish and Wildlife Service, Office of Biological Sciences Report FWS/OBS-78/29. March, 1978. 260 p, 29 Fig, 62 Tab, 371 Ref, 7 Append.

Descriptors: *Powerplants, *Coal, *Water pollution effects, Power operation and maintenance, Environmental effects, Wildlife habitat, Aquatic habitat, Acid mine water, Chemical wastes, Air pollution, Water pollution, Pollution abatement, Pollutants.

This report contains an assessment of expected impacts to terrestrial and aquatic biota and their habitats which are associated with the operation of coal-fired power stations, from the point at which coal is delivered to the site through disposal of process wastes. Emphasis is placed on discussion of impacts unique to coal combustion, although some features of gas- and oil-fired stations are also addressed. Impacts arising from thermal effluents, condenser cooling facilities, and power transmission are not discussed. Mitigative measures to reduce the magnitude of some of these adverse impacts are described, and include pollution abatement devices, erosion control proper siting and lining of ash and sludge disposal ponds, and reclamation of inactive waste-disposal sites. Included in the report is a list of research topics suggested to improve impact assessment capabilities. (Steiner-Mass)
W80-03518

EFFECTS OF OFF-ROAD VEHICLES ON THE SEDIMENTS OF HATCHES HARBOR, CAPE COD NATIONAL SEASHORE,
Massachusetts Univ., Amherst. Dept. of Geology.
J. A. Hamilton.
Massachusetts University, National Park Service Cooperative Research Unit Report No 30, 1978. 23 p, 21 Fig, 1 Tab, 27 Ref.

Descriptors: *Off-road vehicles, *Sediments, *Intertidal areas, *Geomorphology, Wetlands, Tidal marshes, Sediment transport, Sedimentation, Massachusetts, Sands, Marshes.

Vehicles (ORVs) can greatly increase the amount of overwash by destroying the developing dune

vegetation on the protective sand spit. These overwash deposits are reworked by the daily tidal flooding in the inlet throat. Areas of exposed sand are subject to sediment transport by tidal action. ORV traffic can increase the amount of open sandy areas and rate of movement, and hence quicken the infilling of Hatches Harbor, by creating new sand channels through marsh areas. Because salt marsh vegetation enhances sedimentation by slowing down water flow, ORV disruption of these grasses would tend to thwart siltation. The net impact of ORV disturbance of salt marsh vegetation through the creation of open sandy areas would still be to increase the infilling of Hatches Harbor because of the large flood dominance of sediment transport. Other effects of ORV traffic on the exposed sand area vary with sand composition and vehicle usage. Vehicle passage disturbs the sediment packing to a depth of a few centimeters, which makes the material in disturbed areas more susceptible to transport by tidal currents than undisturbed surfaces. (Steiner-Mass)
W80-03535

EFFECTS OF OFF-ROAD VEHICLES ON PLANTS OF A NORTHERN MARSH,
Massachusetts Univ., Amherst.
J. M. B. Brodhead, and P. J. Godfrey.
Report No 33, 1979. 65 p, 35 Fig, 2 Tab, 16 Ref.

Descriptors: *Marsh plants, *Off-road vehicles, *Vegetation regrowth, Wetlands, Marshes, Salt marshes, Marsh management, Peat, Massachusetts.

The impact of off-road vehicles (ORVs) on the marsh and tidal sand flat environment was determined through controlled impacts of undisturbed sites and the enclosure of ORVs on disturbed sites. Results show that ORV traffic in the low marsh completely destroys both vegetation and peat substrate and produces conditions that delay the rates of natural recovery as well as creates conditions that favor mosquito production. Traffic around the periphery of the marsh creates an ever-growing barren zone with erosion of adjacent dunes and continual degradation of both marsh and dune systems alike. Only a few passes of an ORV are sufficient to severely damage salt marsh species. Recovery, however, begins soon after protection from impacts. Plants found along the dune/marsh border, Ammophila and Spartina patens (erect), can recover in about two years. Full colonization of a barren flat can occur in two years. Spartina alterniflora begins invading disturbed peat substrate slowly but will develop nearly complete cover in four years. Spartina patens (decumbent) is the slowest marsh plant to recover following complete destruction. (Steiner-Mass)
W80-03536

4D. Watershed Protection

COMBINED VEGETATIVE-STRUCTURAL SLOPE STABILIZATION,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
D. H. Gray, A. T. Leiser, and C. A. White.
Civil Engineering-ASCE, Vol 50, No 1, p 82-85, January 1980. 3 Fig, 2 Tab, 7 Ref, 4 Photo.

Descriptors: *Slope stabilization, *Vegetation establishment, *Erosion control, *California, Bank stabilization, Methodology, Vegetation, Costs, Bank protection, Slope protection, Soils, Embankments, Wattling.

Vegetation in partnership with structural measures provides an attractive and cost effective method of stabilizing slopes and combating erosion. An effective approach is to use contour wattling, willow cuttings, or conventional slope plantings in combination with a low breast wall, gabion revetment, or bench structure constructed at the toe of a slope. Another approach is to grow vegetation in the voids of interstices of structural walls or revetments. The role of vegetation in stabilizing slopes was described; criteria and guidelines for successful wattling or revegetation of slopes were also discussed. Examples and cost comparisons were presented of recent vegetative-structural slope treatments used in the Lake Tahoe Region of California. (Humphreys-ISWS)
W80-03455

EFFECT OF SEDIMENT CONTROL DAMS ON THE WATER QUALITY OF A PRAIRIE LAKE,
South Dakota State Univ. Dept. of Biology.
L. Haertel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147515, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Institute, South Dakota State University, Completion Report, February 1980. 53 p, 2 Fig, 23 Tab, 28 Ref, 2 Append. OWRT A-061-SDAK (1), 14-34-0001-7088.

Descriptors: *Sediment control, Effects, *Water quality, *Lakes, South Dakota, Dams, Pre-impoundment, Post-impoundment, Water analysis, *Sediment control dams, Algal blooms, Water transparency, Prairie lakes, Nutrient levels.

Water transparency (secchi disc), algal bloom density (chlorophyll a and cell counts) and nutrient chemistry (NH3-N, NO3-N, Organic N, Orthophosphate-P and Total P) were sampled on Lake Cochrane, SD from 1976-1979 during and after sediment dam construction. These data were compared with previous data taken from other studies on Lake Cochrane 1970-1975 using the same sampling techniques. Data were separated by season and compared between years by analysis of variance. 1977 and 1978 (1 and 2 years after sediment dam construction) were consistently higher in nutrient levels for all seasons than other years. 1977 (1 year after construction) was poorest in water transparency for all seasons. Erosion off the steep slopes from the construction is probably responsible for the high nutrient levels and low water transparency observed during those years. Unusually low rainfall in 1976 probably prevented erosion from being a problem during the year of construction. Chlorophyll a analysis of variance indicates that 1978 and 1979 were not significantly different from 1970, the year of lowest algal concentrations and best water transparency measured possibly indicating a trend toward improved water quality after sediment dam construction. However, water transparency readings from 1971 to 1979, were significantly poorer than in 1970. Algal species composition also indicated more eutrophic conditions from 1971-1979 than existed in 1970. (Wiersma-South Dakota)
W80-03477

LABORATORY EVALUATION OF METHODS TO SEPARATE FINE GRAINED SEDIMENT FROM STORMWATER,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
L. M. Bergstedt, J. M. Wetzel, and J. A. Cardle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-121528, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-076, July 1979. 40 p, 12 Fig, 2 Tab, 4 Ref. R 803579.

Descriptors: *Separation techniques, *Erosion control, *Sediment control, *Storm runoff, Settling basins, Laboratory tests, Construction, Particle size, Sediments, Flocculation, Water pollution sources, Suspended load, Trap efficiency, Water purification.

Two commercially available solid separation devices, an inclined tube settler and a Discostrainer, were tested to study their ability to remove inorganic solids that are less than 100 microns in size from stormwater. These two devices were selected for testing following a literature survey of the various methods for separation of sediment from stormwater at construction sites. Full-scale units were laboratory tested with influent concentrations of approximately 2000 mg/l. The inclined settler tube, manufactured by Neptune Microfloc, Inc., showed some capability for removing fine, inorganic solids from water. Installation of a settler tube to a sedimentation basin was found to reduce the sensitivity of solid removal to overflow rate. The settler tube increases basin efficiency thereby reducing the size of the required sedimentation basin. It was also found that the addition of alum to influent caused increased flocculation and increased solids removal by approximately 6%. The performance of the Discostrainer was marginal with 30% removal of solids at an influent concentration of 1300 mg/l and a 10% removal rate at 2100 mg/l. Tests results for the devices indicate great difficulty in separating the desired size solids from water using physical processes. The cost of using such devices at construction sites may not be economically justifiable. (Seigler-IPA)
W80-03566

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

LABORATORY OBSERVATIONS ON THE INFLUENCE OF TEMPERATURE AND SALINITY ON DEVELOPMENT OF THE EGGS AND GROWTH OF THE LARVAE OF SOLEA SOLEA (PISCES),
Nederlands Inst. voor Onderzoek der Zee, Texel.
M. Fonds.
Marine Ecology-Progress Series, Vol 1, p 91-99, 1979. 3 Fig, 6 Tab, 39 Ref.

Descriptors: *Water temperature, *Salinity, *Growth rates, *Marine fish, Fish eggs, Larval growth stage, Mortality, Salt tolerance, Thermal stress, Fish physiology, Fish behavior, Spawning, *Sole, *Solea.

Eggs of the sole Solea solea (L.) were incubated at different constant temperatures (10, 13, 16, 19, 22C) and salinities, 10, 20, 30, 40, 50 o/oo); the larvae were reared at the same temperatures but at one salinity (30 o/oo S). High survival and normal development to hatching were observed at temperatures from 10 to 16C and salinities from 20 o/oo to 40 o/oo S. The growth rate increased with increasing size of the larvae and also increased with the rearing temperature to a maximum at 22C. Some environmental factors which may influence the survival of sole eggs and larvae in the sea are discussed. (Deal-EIS)
W80-03329

RESPONSES OF THE FISH BLENNIUS PHOLIS TO FLUCTUATING SALINITIES,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
J. Davenport, and O. Vahl.
Marine Ecology-Progress Series, Vol 1, p 101-107, 1979. 4 Fig, 2 Tab, 26 Ref.

Descriptors: *Salinity, *Toxicity, *Respiration, Fish physiology, Animal metabolism, Osmosis, Oxygen requirements, Fish behavior, Dissolved oxygen, Cycles, Salt tolerance, *Blenny, *Blennius, *Tissue analysis, *Blood chemistry, *Ventilation rates, *Acclimation.

Blennius pholis (L.) were exposed to fluctuating salinity regimes of near tidal periodicity and their blood osmolality, oxygen consumption, heart rate and opercular beat monitored. Despite salinity fluctuations from 34-0-34 o/ooS, the blood osmolality remained constant. Significant increases in oxygen consumption were observed at low salinity levels, but these may simply reflect changes in physical activity and the greater availability of oxygen at low salinities. Salinity effects upon heart rate/opercular beat were weak or negligible. (Deal-EIS)
W80-03330

BENTHIC INVERTEBRATES OF THE LOWER MISSISSIPPI RIVER,
Geological Survey, Baton Rouge, LA.
F. C. Wells, and C. R. Demas.
Water Resources Bulletin, Vol 15, No 6, 1565-1577, 1979. 3 Fig, 1 Tab, 25 Ref.

Descriptors: *Benthic fauna, *Mississippi River, *Biological communities, Aquatic populations, Dominant organisms, Worms, Insects, Diptera, Clams, Isopods, Mollusks, Mayflies, Amphipoda, River flow, Aquatic habitats, Water chemistry, Industrial wastes, Municipal wastes.

In 1976-77, benthic invertebrates were sampled at four sites in a 410 kilometer reach of the lower Mississippi River to define the communities in the river and to determine differences between communities upstream and downstream from the industrial and municipal complexes of Baton Rouge and New Orleans, Louisiana. The most common and most numerous organisms collected were Corbicula and tubificid worms. The benthic community structure of the lower Mississippi River is influenced by substrate type and stability, channel geometry, river velocity, vegetation and organic detritus, and salinity. Sampling stations near the left and right banks had low velocities, and substrate types ranged from medium silt to very fine sand. Burrowing organisms such as tubificids, chironomids, and ephemerid-type mayflies dominated these environments. At the center, left-center, and right-center stations, velocities were higher and substrate materials were coarser than at the bank stations; only Corbicula was present in large numbers. Near the river mouth, salinity and aquatic vegetation greatly affect the benthic community structure. Differences in benthic community structure in the Mississippi River are due primarily to different hydrologic conditions. Industrial and municipal wastes discharged into the river appear to have little or no widespread effects on benthic populations. (Deal-EIS)
W80-03333

EVALUATION OF CUTRINE FOR USE IN FISH CULTURE,
New York State Dept. of Environmental Conservation, Rome.
J. C. Skea, and H. A. Simonin.
The Progressive Fish Culturist, Vol 41, No 4, p 171-174, 1979. 5 Tab, 7 Ref.

Descriptors: *Algicides, *Toxicity, *Bass, *Minnows, Copper compounds, Bioassay, Mortality, Fish management, Fish hatcheries, Aquatic algae, Water chemistry, Cladophora, *Cutrine.

Laboratory and field tests were conducted with Cutrine, a chelated copper algicide registered for use in fish hatcheries. The 96-h LC50 for fingerling largemouth bass (Micropterus salmoides) was found to be 70 microl/l Cutrine (6.4 mg/l Cu) at 21.1C and 2.3 microl/l (0.21 mg/l Cu) for fathead minnows (Pimephales promelas) at 18.3C. When Cutrine was applied at a rate of 2.3 microl/l (0.75 gal/A-ft) to half of a rearing pond for fathead minnows, the amount of filamentous algae was substantially reduced. Caged largemouth bass and fathead minnows showed less than 10% mortality in the treated area of the pond. (Deal-EIS)
W80-03335

SAPROLEGNIA: CONTROL OF FUNGUS ON INCUBATING EGGS OF PINK SALMON BY TREATMENT WITH SEAWATER,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
S. G. Taylor, and J. E. Bailey.
The Progressive Fish-Culturist, Vol 41, No 4, p 181-183, 1979. 3 Tab, 6 Ref.

Descriptors: *Fish eggs, *Fungicides, *Pink Salmon, *Sea water, Fish management, Fish hatcheries, Mortality, Fish diseases, Disinfection, Growth stages, *Saprolegnia, *Malachite green.

Daily 2- to 3-h treatments with seawater safely and effectively controlled Saprolegnia diclina on eggs of pink salmon (Oncorhynchus gorbuscha) in two trials at Auke Creek Hatchery, southeastern Alaska. Survival in gravel incubators from the fertilized-egg stage to the fry stage was significantly higher (P+0.005) with seawater treatment (68%) than with no treatment (41%). In tray incubators, survival from the fertilized-egg stage to the eyed-egg stage averaged 95% for the 1971 to 1976 broods after malachite green treatments and 96% for the 1977 brood after seawater treatments. (Deal-EIS)
W80-03336

IODOPHOR DISINFECTION OF MUSKELLUNGE EGGS UNDER INTENSIVE CULTURE IN HATCHERIES,
New York State Dept. of Environmental Conservation, Rome.
J. H. Schachte, Jr.
The Progressive Fish Culturist, Vol 41, No 4, p 189-190, 1979. 1 Tab, 6 Ref.

Descriptors: *Disinfection, *Fish hatcheries, *Fish management, Iodine, Pikes, Fish eggs, Toxicity, Mortality, Fish reproduction, Pathogenic bacteria, Bactericides, Fish diseases, *Iodophors.

The iodophor Povidone-Iodine (1% active I2) was used at three concentrations, 100, 28, and 13 mg/l(1:100, 1:350, and 1:750) for 10 min. in an attempt to disinfect fertilized eggs of muskellunge (Esox masquinongy) and to test the efficacy and toxicity of the compound on the eggs of cool-water species. No treatment effect was observed between treatments and controls or among treatments. However, no toxic effects of the iodophor were found at the concentrations of active I2 considered efficacious for salmonids. (Deal-EIS)
W80-03337

INHIBITION OF CARBON FIXATION AS A FUNCTION OF ZINC UPTAKE IN NATURAL PHYTOPLANKTON ASSEMBLAGES,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
A. G. Davies, and J. A. Sleep.
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 937-949, 1979. 2 Fig, 4 Tab, 29 Ref.

Descriptors: *Zinc, *Inhibition, *Photosynthesis, *Phytoplankton, Radiochemical analysis, Tracers, Zinc radioisotopes, Carbon radioisotopes, Chlorophyll, Absorption, Mode of action, Plant physiology, Toxicity, Heavy metals, Analytical techniques, *Tissue analysis, *Bioaccumulation.

By developing a method for discriminating between the radioactivities of 14C and 65Zn, it has proved possible to measure the influence of zinc upon the carbon fixation rates of natural phytoplankton communities as a function of both the zinc concentrations in the water and the zinc/chlorophyll a ratios in the plant cells. Photosynthesis in the phytoplankton assemblages in the English Channel during July 1978 was found to be inhibited at zinc concentrations which have been reported to be present in the waters of some other coastal regions around the British Isles. Zinc/chlorophyll a ratios in the phytoplankton were related to the zinc levels in the water by an expression analogous to the Langmuir adsorption isotherm and, presumably due to the near saturation of the zinc binding sites in the plant cells, began to approach their maximal values at zinc concentrations above about 30 microg/l. As the carbon fixation rates were linearly correlated with the zinc/chlorophyll a ratios, these too began to level-off at about the same concentration, higher zinc values causing very little further inhibition. The experimental data are shown to be in good agreement with an expression which describes the effect of zinc upon carbon fixation rates in phytoplankton simply in terms of the zinc binding capacity of the cells and the zinc concentration in the water. This indicates that, as in cultures, the growth rates of natural phytoplankton are also governed by the cellular contents of rate-limiting constituents rather than by the concentrations in the water. (Deal-EIS)
W80-03340

A COMPARATIVE STUDY OF THE CLOSURE RESPONSES OF SOME CIRRIPEDE SPECIES EXPOSED TO FALLING SEAWATER CONCENTRATIONS,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
D. F. Cawthorne.
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 811-817, 1979. 5 Fig, 12 Ref.

Descriptors: *Animal behavior, *Salinity, Salt tolerance, Habitats, Adaptation, Animal physiology, Sea water, Estuarine environment, Osmosis, Membrane processes, Physiological ecology, *Barnacles.

The closure response to low external salinity of three species of intertidal and estuarine barnacle (Balanus balanoides, B. crenatus and Elminius modestus) when exposed to various rates of salinity change were investigated. Comparisons were made between the responses of specimens collected from estuarine and coastal sites. In addition the responses of the brackish water barnacle Balanus improvisus were measured. Three species, B. crenatus, B. improvisus and E. modestus showed no sensitivity to rate of salinity change except at extremely high and unphysiological rates of concentration change. B. balanoides exhibited a sensitivity to rate of salinity change, closure occurring at lower sea water concentrations, with slow rates of change. There was no difference between the response of estuarine and coastal specimens of this species, whilst in B. crenatus and E. modestus, estuarine specimens closed at a significantly lower concentration for a given rate of salinity change. (Deal-EIS)
W80-03342

EUGLENACEA AND CHRYSOPHYCEAE AS ORGANISMS INVOLVED IN POLLUTION OF THE MARINE LITTORAL (IN FRENCH),
Institut Romania de Recherces Marines, Constantsa.
P. E. Mihnea.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 471-475, 1979. 9 Fig, 4 Ref, (English summary).

Descriptors: Algae, Phytoplankton, Phosphates, Nutrients, Plant physiology, Marine algae, Water pollution effects, Nutrients, Biochemical oxygen demand, Laboratory tests, Bioassays, Growth, Water temperature.

Both the frequency and the biological cycle of Euglenaceae and Chrysophyceae, as well as their correlation with environmental conditions, are analysed. The optimum temperature, positive correlation with CB05, P-P04, and the ratio N/P; all explain the occurrence and the development of the unicellular algae groups studied. The relationship of these algae to the environmental variables explain their role in the purification of the marine littoral. Algae demonstrate their ability to adapt to a wide range of water temperatures. (Katz-EIS)
W80-03345

MEIOFAUNA DEVELOPMENT ON ARTIFICIAL SOFT BOTTOMS IN KIEL BAY (IN GERMAN),
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
W. Scheibel, and H. Rumohr.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol 32, p 305-312, 1979. 5 Fig, 2 Tab, 9 Ref, (English summary).

Descriptors: *On-site tests, *Dominant organisms, Biological communities, Nematodes, Benthic fauna, Sediments, Aquatic populations, Biomass, Analytical techniques, Research equipment, *Colonization, *Harpacticoides, *Baltic Sea.

The 'Benthosgarten', an enclosed area in the western Baltic Sea, is used for benthos ecology experiments. It consists of different kinds of sediment containers filled with 'artificial' soft bottom. These containers were sampled by divers over a one-year period to observe the development of the meiofauna population. The first settlement, mainly by nematodes, took place immediately after exposure, and six months later the population was stabilized. The meiofauna consists mainly of nematodes and harpacticoides. Biomass and density are generally lower than in the surrounding area. Only the har-

pacticoid fauna is well represented by different species and has more individuals per sqm than the surrrounding area. Biological aspects of the specific features of the sediment containers, e.g. size and their distance to the sea bottom are discussed. (Deal-EIS)
W80-03346

TRACE ELEMENT RELEASE FROM ESTUARINE SEDIMENTS OF SOUTH MOSQUITO LAGOON NEAR KENNEDY SPACE CENTER,
Savannah State Coll., GA.
M. P. Menon, G. S. Ghuman, and C. O. Emeh.
Water, Air, and Soil Pollution, Vol 12, No 3, p 295-306, October 1979. 3 Fig, 3 Tab, 25 Ref. NASA NSG803.

Descriptors: *Analytical techniques, *Chemical analysis, *Trace elements, *Metals, Lagoons, Sediments, Sampling, Laboratory tests, Ions, Zinc, Manganese, Cadmium, Copper, Pollutants, Pollutant identification, Water pollution, Estuaries.

Analytical partitioning of four trace metals in estuarine sediments collected from eight sites in South Mosquito Lagoon, near Kennedy Space Center, in terms of four different categories was accomplished using four different extraction techniques. The concentrations of the four trace metals, Zn, Mn, Cd, and Cu, released in interstitial water extract, 1 N ammonium acetate extract, conc. HCl extract, and fusion extract of sediments as well as their concentrations in water samples collected from the same location were determined using flame atomic absorption technique. From the analytical results the percentages of total amount of each metal distributed among four different categories, interstitial water phase, acetate extractable, acid extractable, and detrital crystalline material, were determined. Our results suggested that analytical partitioning of trace metals in estuarine sediments may be used to study the mechanism of incorporation of trace metals with sediments from natural waters. A correlation between the seasonal variation in the concentration of acetate-extractable trace metals in the sediment and similar variation in their concentration in water was observed. A mechanism for the release of trace metals from estuarine sediments to natural water was also suggested. (Sims-ISWS)
W80-03355

USE OF SYNOGRAPHIC TECHNIQUES IN RESEARCH AND DISSEMINATION OF HYDROLOGICAL INFORMATION,
Texas Univ. at Houston. School of Public Health.
For primary bibliographic entry see Field 7C.
W80-03360

THE PROBLEM OF PHOSPHORUS IN THE EUTROPHIC LAKE MARYUT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 5B.
W80-03371

SAFEGUARDS FOR GROUNDWATER,
For primary bibliographic entry see Field 6E.
W80-03422

ORGANIC QUALITIES OF GROUNDWATERS,
Arizona Univ., Tucson. Dept. of Civil Engineering.
D. R. Kasper, and K. S. Knickerbocker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147267, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona. Project Completion Report, February 1980. 15 p, 3 Fig, 3 Tab, 5 Ref, OWRT A-067-ARIZ(1), 14-34-0001-6003.

Descriptors: *Organic wastes, *Percolation, Groundwater, *Activated sludge, Path of pollutants, Sampling, Water wells, Water analysis, Water supply, *Colorform extract method, Groundwater organics, Wastewater recharge, Groundwater quality, Tucson(Ariz).

The total organic content or recharged secondary effluents as measured by the miniaturized carbon chloroform extract method (CCE-m) was investigated by analyzing waters from wells located at various distances from recharge areas. It was found that the CCE-m organic concentration decreased with increasing percolation distance. Secondary activated sludge effluent was found to contain 3.80 mg/l CCE-m. Percolation through 100 feet of porous media reduced the CCE-m value to less than 0.50 mg/l. This is less than the EPA proposed 1974 Drinking Water Standard of 0.70 mg/l. Fourteen wells located a minimum of 1,000 feet from an ephemeral stream receiving secondary effluent had CCE-m values less than 0.20 mg/l. A general survey of deep wells known not to receive any wastewater recharge found CCE-m values varying from 0.04 to 0.30 mg/l. It is probable that the oil lubrication methods employed in deep wells resulted in these CCE-m values.
W80-03437

LONGEVITY AND REPRODUCTION OF DAPHNIA PULEX (DE GEER) EXPOSED TO CADMIUM-CONTAMINATED FOOD OR WATER,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
P. E. Bertram, and B. A. Hart.
Environmental Pollution, Vol 19, p 295-305, 1979. 4 Fig, 2 Tab, 18 Ref. OWRT A-023-VT(2).

Descriptors: *Cadmium, *Toxicity, *Daphnia, Chlorella, Chlorophyta, Reproduction, Life history studies, Fertility, Fecundity, Heavy metals, Path of pollutants, Absorption, Crustaceans, Chemical analysis, *Tissue analysis, *Bioaccumulation.

The effect of cadmium on the survival and reproductive capacity of Daphnia pulex was determined. Cadmium was present either in the water at chronic (1-30 microgram Cd/litre) and acute (40-90 microgram Cd/litre) levels or in the algal food source, Chlorella pyrenoidosa. The average longevity of D. pulex was not affected by exposure to 1 microgram Cd/litre but it was reduced in a dose-dependent manner between 5 and 30 microgram Cd/litre. Exposure to cadmium had no effect on the number of days to onset or frequency of reproduction but it did cause a reduction in the percentage of adults producing young, the number of broods per adult, the number of young per brood, the number of progeny per adult, the intrinsic rate of natural increase (r), and the mean generation time (T). Cadmium-laden Chlorella caused the same effects as did exposure to 1 microgram Cd/litre. (Deal-EIS)
W80-03439

QUALITY OF RUNOFF FROM LAND RECEIVING SURFACE APPLICATION AND INJECTION OF LIQUID DAIRY MANURE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03443

MONITORING OF TOTAL AMOUNT OF LIPOPHILIC ORGANO CHLORINE COMPOUNDS IN A SWEDISH RIVER,
Goteborg Univ. (Sweden). Institutionen for Analytisk Kemi.
For primary bibliographic entry see Field 5B.
W80-03458

EFFECTS OF LIMESTONE STRIP MINING ON BENTHIC MACROINVERTEBRATE COMMUNITIES,
Calgary Univ. (Alberta). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-03460

MODIFIED AMPEROMETRIC MEMBRANE PROBES FOR DETERMINING FREE AND TOTAL RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Research Labs.
N. A. Dimmock, and D. Midgley.
Water Research, Vol 13, No 12, p 1317-1327, 1979. 7 Fig, 2 Tab, 9 Ref.

Descriptors: *Chlorine, *Cooling water, *Instrumentation, Equipment, Chemistry, Salinity, Potassium compounds, Hydrogen ion concentration, Chemical reactions, Water chemistry, Chemical analysis, Electrodes, Membrane probes.

Modifications have been made to a Delta Scientific model 82124 free available chlorine probe so that it can be used to determine either the free or the total residual chlorine in cooling waters at coastal and estuarine power stations. For measurements of free residual chlorine, the internal filling solution of the probe was changed for one containing potassium bromide at pH 4. When the sample solution was dosed with potassium bromide and pH 4 buffer, the probe had a linear response over the range 0.04-1.0 microgram/milliliter C12, and errors caused by changes in salinity were negligible. Total standard deviations for the analysis of 1.0 and 0.1 microgram/milliliter C12 solutions were 0.055 and 0.01 microgram/milliliter C12, respectively. For measurements of total residual chlorine a potassium iodide solution at pH 4 was used as the probe's internal filling solution, and the sample solution was dosed with potassium iodide and pH 4 buffer. The probe had a linear response over the range 0.02-0.5 microgram/milliliter C12, with total standard deviations of 0.05 and 0.01 microgram/milliliter C12 at concentrations of 0.5 and 0.1 microgram/milliliter C12, respectively. (Sims-ISWS)
W80-03462

AN AUTOMATED PROCEDURE FOR THE DETERMINATION OF PHOSPHORUS,
Foras Forbartha, Dublin (Ireland).
L. J. Lennox.
Water Research, Vol 13, No 12, p 1329-1333, 1979. 4 Fig, 4 Tab, 6 Ref.

Descriptors: *Analytical techniques, *Chemical analysis, *Phosphorus, *Water chemistry, Chemistry, Water pollution, Pollutants, Nutrients, Pollutant identification, Phosphorus compounds, Sewage, Sewage effluents, Fertilizers, Rivers, Lakes, Reservoirs.

Procedures for the determination of dissolved orthophosphate and total phosphorus in surface fresh waters (e.g., rivers, lakes, and reservoirs) and organic wastes (e.g., domestic sewage, creamery effluents, and the like) (particulate or dissolved) were described. Total phosphorus compounds were converted to orthophosphate by acid persulfate digestion. The digestion time was 3 h which goes to completion without any supervision. The method allowed for a maximum of 36 samples, 2 blanks, and 2 standards to be processed simultaneously. There was no pH adjustment required. Interference from silica and iron (III) up to 20 mg/l was absent. Detection limits for the automated step involving orthophosphate were 1 microgram/liter. Recovery and effectiveness of proposed procedures were excellent. (Sims-ISWS)
W80-03463

HUMIC AND FULVIC ACIDS AS INDICATORS OF SOIL AND WATER POLLUTION,
Department of Agriculture, Ottawa (Ontario). Chemistry and Biology Research Inst.
H. Kerndorff, and M. Schnitzer.
Water, Air, and Soil Pollution, Vol 12, No 3, p 319-329, October 1979. 6 Fig, 7 Tab, 20 Ref.

Descriptors: *Indicators, *Water pollution, *Soil contamination, *Humic acids, *Fulvic acids, Sampling, Surveys, Sediments, Pollutants, Pollutant identification, Chemicals, Chemical analysis, Analytical techniques, Carbon, Hydrogen, Nitrogen, Sulfur, Oxygen, Statistical analysis, Data processing.

Humic substances are the major organic components of soil and sediments, but little is known on how they are affected by environmental and industrial pollution. To find out whether such effects could be recognized, a number of analytical characteristics were compared of humic and fulvic

acids extracted from unpolluted and polluted soils and sediments. The main differences were that, per unit weight, polluted humic and fulvic acids contained more N, S, and H but fewer C02H groups, and were more aliphatic than unpolluted samples. Unusually high N and S contents of humic materials appear to be the most valid indicators of pollution. Humic acids are preferred to fulvic acids as indicators of pollution because the former are more readily separated and purified. (Sims-ISWS)
W80-03465

AERIAL INPUTS OF CADMIUM, COPPER, LEAD, AND MANGANESE INTO A FRESHWATER POND IN THE VICINITY OF A COAL-FIRED POWER PLANT,
Savannah River Ecology Lab., Aiken, SC.
J. G. Wiener.
Water, Air, and Soil Pollution, Vol 12, No 3, p 343-353, October 1979. 5 Tab, 54 Ref. DOE EY-76-C-09-0819.

Descriptors: *Chemistry of precipitation, *Metals, *Air pollution, *Water pollution sources, *Powerplants, *South Carolina, Fly ash, Coals, Sampling, Rainfall, Precipitation(Atmospheric), Laboratory tests, Chemical analysis, Cadmium, Copper, Lead, Manganese, Data processing, Regression analysis.

Cadmium, Cu, Mn, and Pb were analyzed in bulk precipitation for 21 months at a 2-ha pond, located 5.5 km northwest of an 83 MW coal-fired power plant in South Carolina. No significant changes in mean concentrations of the four metals in bulk precipitation were observed after installation of modern electrostatic precipitators on the stacks of the power plant, which previously had been equipped with mechanical cyclone collectors for removal of fly ash. Hence, fly ash from stack emissions was apparently not a major source of aerially deposited trace metals at the pond site. Annual imputs of the four metals in bulk precipitation at the pond were similar to values reported for other rural areas in North America. Enrichment factors, with Mn as a reference element, indicated that Cd, Cu, and Pb in bulk precipitation were not derived from soil or crustal material. Cadmium, Cu, and Pb were enriched in all samples of bulk precipitation relative to their abundances in local soils and were most enriched during autumn and winter. A multiple regression procedure suggested that wetfall was the primary mode of aerial deposition of Cd and Cu, whereas both wetfall and dryfall were important modes of aerial deposition of Pb. (Sims-ISWS)
W80-03466

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN--I. NUTRIENT INFLUX AND PHYTOPLANKTON BLOOM,
Tsukiba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, M. Takahashi, and S. Ichimura.
Water, Air, and Soil Pollution, Vol 12, No 3, p 383-391, October 1979. 9 Fig, 19 Ref.

Descriptors: *Algae, *Eutrophication, *Lakes, *Nutrients, Water pollution effects, Agricultural runoff, Agricultural chemicals, Farm wastes, Fertilizers, Water pollution, Pollutants, Water temperature, Chlorophyll, Dissolved oxygen, Bacteria, Phosphates, Nitrogen compounds, Phytoplankton, Sampling, Limnology, *Japan.

The heaviest algal bloom that can be expected in an aquatic system was formed in a waterchestnut ecosystem in Lake Kasumigaura during the summer in 1978 when the water temperature was greater than 30C, caused by the nutrient discharges from the River Koise and the River Sanno. The heavy bloom not only threatens the steady-state equilibrium of the eutrophic system of the lake but also must accelerate the lake transformation into a low moor by forming ooze on the lake bottom with the precipitation of a large amount of dead blue-green algae. (Sims-ISWS)
W80-03467

PRODUCTION OF HALOFORM PRECURSORS BY WATER PIPE BACTERIAL FILMS.
Missouri Univ.-Rolla. Dept. of Civil Engineering.
D. B. Jacquez, and D. K. Muckerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147002, Price codes: A04 in paper copy, A01 in microfiche. Missouri water Resources Research Center, University of Missouri. Completion Report. November 1979. 61 p, 12 Fig, 10 Tab, 25 Ref. USDI-OWRT-14-34-0001-9027, A-108-MO (1).

Descriptors: Bacteria, Chlorination, *Trihalomethanes, Chloroform, Slime.

The objective of this investigation was to determine the potential for bacteria films coating the interior of water distribution lines to act as organic precursors to the formation of trihalomethanes (THMs). Experiments were conducted in a static manner by chlorinating one foot sections of four inch diameter cast iron pipe which contained a film of bacteria native to the Rolla, Mo tap water system. A water pipe bacterial film was demonstrated to act as an organic precursor by chlorinating a set of pipes with and without a bacterial film. A clean pipe and a chlorine dose of 2.5 mg/l established a 24 hour baseline total THM (TTHEM) production level of 4 ug/1 for the Rolla tap water. Including the bacterial aline growth increased the TTHM level to 19 ug/1 at a chlorine dose of 2.9 ug/1. Further increasing the chlorine dose to 94 mg/1 produced a TTHm level of 86 ug/1 at the end of 24 hours. The pH of the Water was shown to have a definite influence on THM production. At a chlorine dose of 0 mg/1, varying the pH from 5.3 to 8.7 increased TTHM production from six to 98 ug/1 during a 24 hour test. Throughout the investigation, chloroform was found to be the predominant THM specie. The average breakdown of THM species resulting from the chlorination of bacterial films can be summarized as follows: 79% chloroform, 17% bromodichloromethane, and four % dibromochloromethane. Bromoform was present, but usually at concentrations less than one ug/1.
W80-03478

DISTRIBUTION OF METALS IN STREET SWEEPINGS, STORMWATER SOLIDS, AND URBAN AQUATIC SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W80-03543

5B. Sources Of Pollution

ENVIRONMENTAL PATH OF ARSENIC IN GROUNDWATER,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. B. Hawkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143662, Price codes: A02 in paper copy, A01 in microfiche. Report No IWR-77, 1976. 7 p, OWRT A-050-ALAS (2), 14-34-0001-6002.

Descriptors: *Arsenic, *Alaska, *Path of pollutants, *Groundwater, Streams, Mining, *Ester Dome area(Alaska), *Pedro Dome-Cleary Summit area(Alaska).

This study determined the arsenic concentration in water of the Fairbanks Mining District. Stream waters had a mean of 24 parts per billion (ppb) of arsenic, and a maximum of 1200 ppb in the Pedro Dome-Cleary Summit area. A positive correlation of arsenic content of stream water and that of suspended and bottom sediment was demonstrated. Significant arsenic contamination of domestic well waters was also revealed in the Ester Dome area. Thirty to 50 percent of the 100 wells sampled had concentrations of arsenic over 50 ppb. The U.S. Public Health Service recommends a limit of 10 ppb, and rejects water with 50 ppb arsenic as a public water supply. The relationships between arsenic contamination and both mining activity and gold mineralization are discussed.
W80-03303

A STUDY OF THE CHARACTERISTICS AND POLLUTION POTENTIAL OF LAND SPREAD DOMESTIC SEPTAGE ON GROUNDWATER QUALITY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
G. R. Beehler, and J. A. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143670, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota Report, January 1980. 48 p, 6 Fig, 28 Tab, 26 Ref, 2 Append, OWRT A-036-MINN (1).

Descriptors: *Septic tank sludge, *Soil treatment, *Water pollution effects, Septage spreading, Infiltration, Groundwater, Path of pollutants.

A three-year study was undertaken to establish the characteristics of septage in Minnesota and to evaluate the effects of land spreading of domestic septage on groundwater nitrate concentration and microbial penetration. TS, TVS, pH, COD, NH3-N, TKN, conductivity and fecal coliforms were examined on 75 samples from two septage haulers. Large variations were noted in all parameters with septage in the Brainerd area possessing mean values 50% lower than septage in the White Bear Lake area. Seven virgin plots were identified and two types of application were proposed. Intermittent spreading imitated actual spreading practices and received + 3,000 gallons per plot per day. Slug loads were utilized to maximize the hydraulic load and pollution potential of the septage applied. Four plots of intermittent loading received 174,000, 169,000, 32,000 and 39,000 gallons of septage during the three-year study. This gallonage represented a total nitrogen application equivalent to 2,400, 1,100, 630 and 290 lbs N/acre. No significant increase in well water nitrates was observed. Slight increases of nitrate nitrogen concentrations were observed in the soil profiles, most notably at the heaviest application of nitrogen applied. Slug loads of 200 to 2,000 gallons per single application on 10 foot x 50 foot plots failed to increase well water nitrate concentrations and only infrequent instances of fecal coliform recovery accurred. These may represent sporadic penetration or be of an iatrogenic source and may or may not be a significant finding. (Blake-Minn)
W80-03306

ACCUMULATION, ELIMINATION, AND METABOLISM OF DICHLOROBENZIDINE IN THE BLUEGILL SUNFISH,
Syracuse Research Corp., NY. Life Sciences Div.
H. T. Appleton, and H. C. Sikka.
Environmental Science and Technology, Vol 14, No 1, p 50-54, 1980. 6 Tab, 22 Ref.

Descriptors: *Animal metabolism, *Sunfishes, *Organic compounds, Absorption, Chemical properties, Chemical wastes, Carbon radioisotopes, Tracers, Fish physiology, Path of pollutants, Public health, *Carcinogens, *Tissue analysis, *Bioaccumulation, *Dichlorobenzidine(DCB).

The bioconcentration, elimination, and metabolism of 3,3'-dichloro-benzidine (DCB), a suspected human carcinogen, were investigated in bluegill sunfish. (14C)DCB was rapidly accumulated by the fish from water containing 5 ppb or 0.1 ppm of the chemical. Based on total 14C residues, bioconcentration factors of 495 to 507 were observed in the whole fish with equilibria achieved in 96 to 168 h. The 14C residues were distributed in both the edible and nonedible portions. (14C)DCB or its metabolites were not completely eliminated upon transfer of the fish to water free of dichlorobenzidine. The only metabolite detected in the fish was an acid-labile conjugate of DCB, which appears to be an N-glucuronide. The ability of DCB to concentrate in aquatic organisms may present a direct hazard to human health through consumption of contaminated fish. (Deal-EIS)
W80-03334

TWO HEAVY METAL-BINDING PROTEINS IN THE MIDGUT GLAND OF THE CRAB CARCINUS MAENAS,
Queen Mary Coll., London (England). Dept. of

Zoology and Comparative Physiology.
P. S. Rainbow, and A. G. Scott.
Marine Biology, Vol 55, p 143-150, 1979. 4 Fig, 6 Tab, 29 Ref.

Descriptors: *Crabs, *Proteins, *Heavy metals, Biochemistry, Animal metabolism, Animal physiology, *Cadmium, *Zinc, *Copper, *Lead, Path of pollutants, Chemical properties, *Tissue analysis, *Bioaccumulation, *Midgut gland.

Two heavy metal-binding proteins occur naturally in the midgut glands of Carcinus maenas (L.) collected from the Firth of Clyde, Scotland. These proteins, of approximately 27,000 and 11,500 MW (molecular weight) have previously been described as Cd-binding proteins after their induction by high concentrations of cadmium in the laboratory. The approx. 27,000 MW heavy metal-binding protein is bound to about 0.10 g-25 of Cd, 0.70 g-at of Zn and 0.31 g-at of Cu per mole of protein; 7.7, 7.9 and 1.1%, respectively, of the soluble Cd, Zn and Cu in the midgut gland are associated with this approx. 27,000 MW protein (6.7, 1.6 and 0.9% of the total midgut gland Cd, Zn and Cu). The approx. 11,500 MW protein is bound to about 0.04 g-at of Cd, 0.37 g-at of Zn and 1.54 g-at of Cu per mole of protein; 29.3, 31.3
W80-03339

INHIBITION OF CARBON FIXATION AS A FUNCTION OF ZINC UPTAKE IN NATURAL PHYTOPLANKTON ASSEMBLAGES,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5A.
W80-03340

ZINC--A MAJOR INORGANIC COMPONENT OF NEREID POLYCHAETE JAWS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
G. W. Bryan, and P. E. Gibbs.
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 969-973, 1979. 3 Tab, 6 Ref.

Descriptors: *Zinc, *Worms, *Habitats, Animal metabolism, Animal physiology, Heavy metals, Chemical analysis, Baseline studies, Bottom sediments, Spectrophotometry, *Polychaetes, *Tissue analysis, *Bioaccumulation.

Analyses of the jaws of nereid polychaetes have shown zinc to be a major inorganic component amounting to between 0.5 and 2.4% of the dry weight and accounting for up to 40% of the total body burden of zinc. In Nereis diversicolor, zinc concentrations in the jaws are not related to those of the habitat sediments. A high zinc content appears to be a structural characteristic of the nereid jaw. (Deal-EIS)
W80-03341

TOTAL MERCURY CONTENT IN SOME MARINE FISH FROM THE INDIAN OCEAN,
National Inst. of Oceanography, Goa (India).
T. W. Kureishy, M. D. George, and R. S. Gupta.
Marine Pollution Bulletin, Vol 10, p 357-360, 1979. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Mercury, *Marine fish, *Path of pollutants, Chemical analysis, Heavy metals, Water chemistry, Chemical wastes, Food chains, Fish physiology, Animal metabolism, Lipids, Sharks, *Tissue analysis, *Bioaccumulation, *Tuna, *Dolphin, *Methylmercury.

Total mercury was estimated in liver, gonads and muscle of some of the marine fishes from the Indian Ocean. The highest mercury concentration was observed in the muscle of sharks while the total mercury concentration was practically non-detectable in the liver and gonads. The range of all the values was 0.09-0.21 ppm (wet weight basis) and is quite low to reflect any possible mercury contamination. (Deal-EIS)
W80-03343

USE OF SYNOGRAPHIC TECHNIQUES IN RESEARCH AND DISSEMINATION OF HYDROLOGICAL INFORMATION,
Texas Univ. at Houston. School of Public Health.
For primary bibliographic entry see Field 7C.
W80-03360

THE PROBLEM OF PHOSPHORUS IN THE EUTROPHIC LAKE MARYUT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
S. D. Wahby, and M. A. A. El-Moneim.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 615-622, November 1979. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Lakes, *Eutrophication, *Phosphorus compounds, *Sewage disposal, Coasts, Brackish water, Sewage, Water pollution, Water pollution sources, Environmental effects, Water pollution effects, Algae, Phosphorus, Sampling, Monitoring, Pollutants, Pollutant identification, Path of pollutants, Limnology, *Egypt, *Lake Maryut(Egypt).

Lake Maryut receives untreated sewage and industrial wastes in its main basin. Its phosphorus content has increased by about 128 times in the past 15 years. Signs of eutrophication are clear. Analysis of inorganic phosphate in the different parts of the lake has been carried out, and the annual phosphorus loading was calculated to be 13.1 mg/l/year which is very high. (Sims-ISWS)
W80-03371

A COMPARISON OF THE AXIAL DISTRIBUTIONS OF SALT AND 137CS IN THE SEVERN ESTUARY DURING AUGUST 1974,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 585-594, November 1979. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Dispersion, *Estuaries, *Salinity, *Radioisotopes, Pollutants, Path of pollutants, Water pollution, Cesium, Salts, Powerplants, Nuclear powerplants, Water pollution sources, Sampling, Monitoring, Coasts, Tidal waters, Data processing, *United Kingdom, *Severn estuary(UK).

A comparison was made of the axial distributions of salt and dissolved 137Cs in a seaward section of the Severn estuary during August 1974. It was shown that these variables were distributed with essentially the same axial dispersion coefficient, and that conditions were effectively stationary. It was also shown that the flushing of 137Cs from the estuary during this period was mainly due to the axial dispersion. The observed concentrations of 137Cs were the linear summation of those due to the northeast Celtic Sea and freshwater background levels (0.65 0.06 pCi/l and approximately 0.08 pCi/l respectively), together with those produced by the three nuclear power generating stations which discharge 137Cs into the estuary. The levels due to the Celtic Sea background amounted to roughly 50% of the observed values, taken as an average over the study area; the levels due to the freshwater background were negligible. (Sims-ISWS)
W80-03373

LONGITUDINAL DISPERSION IN RIVERS,
National Water Research Inst., Burlington (Ontario).
S. Beltaos.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15118, p 151-172, January 1980. 9 Fig, 30 Ref, 1 Append.

Descriptors: *Dispersion, *Rivers, *Mixing, *Model studies, Mathematical models, Pollutants, Path of pollutants, Water pollution, On-site data collections, Calibrations, Streams, Streamflow, Turbulence, Hydraulics.

To explain the frequent deviation of longitudinal dispersion observations in rivers from the Fickian dispersion theory, a two-parameter model was developed. This model was based on reevaluation of the mixing length concept and the assumption that the characteristic irregularity of rivers retards the onset of the Fickian process. The model suggested that there are three distinct dispersion ranges. Within a characteristic stream length from the source, the temporal spread of the dispersing cloud increases linearly with distance; concentration-time curves at different locations along the stream are similar and can be predicted if a dimensionless coefficient is known. The Fickian process occurs at distances exceeding about three times the characteristic stream length. Transitional behavior occurs in the intermediate range. Published field data were analyzed to test the model and evaluate the dispersion parameters. The river length marking onset of Fickian dispersion was found to be up to 30 times that of a corresponding prismatic channel; it was estimated that Fickian dispersion is not likely to occur within lenghts of practical interest in any but small streams. (Sims-ISWS)
W80-03378

THE SURVIVAL OF COLIFORM BACTERIA IN SALINE SEDIMENTS,
New South Wales Univ., Kensington (Australia). School of Microbiology.
M. M. Roper, and K. C. Marshall.
Australian Water Resources Council Technical Paper No 43, 1979. 73 p, 46 Fig, 2 Tab, 77 Ref.

Descriptors: *Coliforms, *E. coli, *Sewage bacteria, *Sediments, Water quality, *Australia, Biocontrol, Bacteriophage, Saline water, Colloids, Bacteria, Animal parasites, Amoebae, Montmorillonite, Clays.

Studies in the Tamar and Georges Rivers in Australia indicate: (1) that coliform bacteria were deposited in bottom muds when the electrolyte concentration (salinity) exceeded a critical conductivity of .25 mmhos cm, and (2) that sediment particulates prolong the survival of the bacteria. Research revealed that biological parasites (bacteriophage, Bdellovibrio), lytic bacteria (Polyangium), and predatory amoebae (Vexillifera) are the major biological agents that rapidly destroy faecal bacteria in natural waters. A colloidal envelope formed around E. coli appears to protect the bacteria from attack. Anaerobic conditions encountered below the sediment-water interface inhibit some agents but not bacteriophage. Dilution of the electrolyte beyond the critical concentration causes the E. coli and other organisms to be desorbed and the sediment colloids to be dispersed. In saline lagoons and estuaries, which are subjected to changes in salinity, E. coli and possibly other faecal microorganisms could present a health hazard if desorbed by dilution as a result of heavy rainfall. (Schaefer-IPA)
W80-03386

TRIAZINE RESIDUES IN A WATERSHED IN SOUTHWESTERN ONTARIO (1973-75),
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
G. C. Roberts, G. J. Sirons, R. Frank, and H. E. Collins.
Journal of Great Lakes Research, Vol 5, No 3-4, p 246-255, 1979. 1 Fig, 7 Tab, 11 Ref.

Descriptors: *Agricultural runoff, *Herbicides, *Pesticide residues, *Triazine pesticides, Organic pesticides, Watersheds(Basins), Water sampling, Clays, Water pollution sources, Pesticide removal, Lake Erie, Ontario, Erosion, Agricultural watersheds.

Creek water from sites on the lower reaches of Hillman Creek in southwestern Ontario was tested to investigate the movement of triazine, a herbicide, in the stream. Hillman Creek drains into Lake Erie from a watershed of 4500 ha. The watershed is largely sandy loam soils with podsolic clay subsoils. Questionnaire results from a farm-to-farm survey in the watershed indicate that 30% of the cropland was treated with s-triazine in 1973 and 1974. During these years water samples were taken from six sites and in 1974 and 1975 26 sites were sampled. Integrated samples of 3 to 4 liters were

taken at each site and flow data were used to calculate herbicide loadings. Three fish species, gizzard shad, black crappie, and brown bullheads, were also tested. Results show that triazines residues were consistently higher upstream than downstream. Specific residues were found in the following percentages of samples: atrazine 89%, desethylatrazine 51%, Simazime 37%, metribuzin 4.4% cyanazine 0.6%, and cyprazine 0.3%. A high of 34.7 micrograms/l Simazime was observed for June and July. Overall only a small fraction (0.3% to 2%) of the applied herbicides reached the stream. Transfer occurs during runoffs and is not connected to steady leaching. Most trazines are adsorbed by clay colloids and organic matter. No triazine herbicide residues were found in the fish analyzed. Broadleaf and annual grasses are expected to be the most triazine susceptible aquatic plants. (Seigler-IPA)
W80-03389

EXECUTIVE SUMMARY OF THE REPORT 'SURFACE IMPOUNDMENTS AND THE EFFECTS OF GROUND WATER QUALITY IN THE UNITED STATES--A PRELIMINARY SURVEY'.
Geraghty and Miller, Inc., Tampa, FL.
EPA Report No EPA-570/9-78-005, June, 1978, 30 p, 1 Fig, 1 Tab.

Descriptors: *Impoundments, *Ground water, *Water quality, Surface water, Water pollution control, Ponds, Lagoons, Seepage, Farm wastes, Industrial wastes, Municipal wastes, Waste disposal, Surveys.

This report summarizes the results of an investigation of the use of municipal, industrial, and agricultural surface impoundments in the United States, with particular reference to the potential threats they may pose to the quality of underground dringking water resources and to methods of controlling or abating such threats. The principal subjects covered in the investigation are: (1) numbers, types and uses of impoundments, (2) chemical characteristics of the impounded wastes, (3) mechanisms by which wastes that seep from impoundments may contaminate ground water, (4) selected case history data on ground water contamination, (5) technical controls and costs for preventing and alleviating contamination, and (6) state regulatory controls over the use of impoundments. (Purdin-NWWA)
W80-03424

MIGRATION OF RADIONUCLIDE CHAINS IN GROUND WATER,
Ford, Bacon and Davis Utah, Inc., Salt Lake City.
V. C. Rogers.
Nuclear Technology, Vol 40, No 10, p 315-320, October, 1978. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Radioisotopes, *Migration, *Ground water, Diffusion, Mass transfer, Uranium radioisotopes, Radium radioisotopes, Equations.

Expressions are presented for determining the maximum concentrations and discharge rates of radioactive nuclide chains migrating by flowing ground water. Nuclide migration is determined from a second-order differential mass balance equation that considers longitudinal dispersion, convection, sorption, and radioactive decay. These expressions are presented for two-member chains that quantify the reconcentration effect in terms of dimensionless parameters. These parameters demonstrate the interrelationships between the basic nuclide and adsorbing medium parameters. The reconcentration effect for the third member of three-member chains is adequately described by the two-member expressions, except the range of reconcentration is extended. This approach provides a relatively simple method of determining an upper limit to the concentrations or release rates of parent and daughter radionuclides in ground water. (Purdin-NWWA)
W80-03433

LONGEVITY AND REPRODUCTION OF DAPHNIA PULEX (DE GEER) EXPOSED TO CADMIUM-CONTAMINATED FOOD OR WATER,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 5A.
W80-03439

QUALITY OF RUNOFF FROM LAND RECEIVING SURFACE APPLICATION AND INJECTION OF LIQUID DAIRY MANURE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
I. J. Ross, S. Sizemore, J. P. Bowden, and C. T. Haan.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1058-1062, September-October 1979. 11 Fig, 2 Ref. OWRT B-047-KY(2).

Descriptors: *Farm wastes, *Application methods, *Runoff, *Water quality, On-site investigations, Injection, Sampling, Chemical analysis, Pollutants, Hydrogen ion concentration, Chemical oxygen demand, Nitrogen, Suspended solids, Coliforms, Dissolved oxygen, Soils, Grasses, Agriculture, Land application.

Liquid dairy manure was applied to the surface and injected into sod and bare soil. Runoff from plots receiving these treatments was analyzed for COD, N, TS, TSS, pH, DO, and fecal coliform. Injection greatly reduced the concentration of these pollutants in the runoff. (Sims-ISWS)
W80-03443

SCIENTIFIC ASPECTS OF THE 1975-76 DROUGHT IN ENGLAND AND WALES,
For primary bibliographic entry see Field 2E.
W80-03444

POLLUTION PROBLEMS ARISING FROM THE 1975-76 DROUGHT,
Anglian Water Authority, Huntingdon (England).
For primary bibliographic entry see Field 2E.
W80-03449

ALGAL AND INVERTEBRATE COMMUNITIES IN THREE SUBARCTIC LAKES RECEIVING MINE WASTES,
For primary bibliographic entry see Field 5C.
W80-03457

MONITORING OF TOTAL AMOUNT OF LIPOPHILIC ORGANO CHLORINE COMPOUNDS IN A SWEDISH RIVER,
Goteborg Univ. (Sweden). Institutionen for Analytisk Kemi.
M. Ahnoff, B. Josefsson, G. Lunde, and G. Andersson.
Water Research, Vol 13, No 12, p 1233-1237, 1979. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Chlorine, *Rivers, *Monitoring, Organic compounds, Organic pesticides, Water pollution, Water quality, Pollutants, Sampling, Pollutant identification, Chemical analysis, Neutron activation analysis, Water pollution sources, Path of pollutants, *Sweden, *Gota River(Sweden).

A sensitive method for the determination of organic bound chlorine in river water has been used in a monitoring program. The amount of organic bound chlorine, extracted by cyclohexane and determined by neutron activation analysis, was chosen as a parameter for detection and tracing of pollutants with annoying or harmful properties. During one year, 216 samples, each collected continuously during 48 h, were taken at seven stations, located at 7-23 km distance along the Gota River, Sweden. The detection limit of the method was below 0.05 microgram Cl/l. Major sources of pollution were localized to certain sections of the river. (Sims-ISWS)
W80-03458

ONE-DIMENSIONAL TRANSIENT MODEL FOR SHORT-TERM PREDICTION OF DOWNSTREAM POLLUTION IN RIVERS,
Vienna Univ. (Austria). Inst. of Meteorology and Geophysics.
P. Kahlig.
Water Research, Vol 13, No 12, p 1311-1316, 1979. 4 Fig, 14 Ref, 1 Append.

Descriptors: *Dispersion, *Tracers, *Rivers, *Model studies, Mathematical models, Pollutants, Path of pollutants, Water pollution, Streams, Streamflow, Flumes, Laboratory tests, On-site investigations, Equations, Mathematics, Mixing, Hydrology.

Using an exact solution of Taylor's dispersion equation (including forced convection and a first-order removal process), the author derived a new routing procedure for short-term prediction of downstream pollution, and compared it to H.B. Fischer's wellknown method. An interaction between the dispersion and removal processes was demonstrated, and its usual negligible effect in river dispersion problems was justified. (See also W69-02368) (Sims-ISWS)
W80-03461

HUMIC AND FULVIC ACIDS AS INDICATORS OF SOIL AND WATER POLLUTION,
Department of Agriculture, Ottawa (Ontario). Chemistry and Biology Research Inst.
For primary bibliographic entry see Field 5A.
W80-03465

AERIAL INPUTS OF CADMIUM, COPPER, LEAD, AND MANGANESE INTO A FRESHWATER POND IN THE VICINITY OF A COAL-FIRED POWER PLANT,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5A.
W80-03466

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN--I. NUTRIENT INFLUX AND PHYTOPLANKTON BLOOM,
Tsukiba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-03467

ROAD DE-ICING SALTS IN AN URBAN STREAM AND FLOOD CONTROL RESERVOIR,
Ontario HYDRO, Toronto.
W. S. Scott.
Water Resources Bulletin, Vol 15, No 6, p 1733-1742, December 1979. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Reservoirs, *Flood control, *Deicers, *Salts, *Canada, *Environmental effects, Highway effects, Water quality, Chlorides, Sodium, Runoff, Streams, Road salt.

High concentrations of chloride and sodium were found in the bottom layers of a new flood control reservoir at the beginning of winter thaw periods. The reservoir had a number of significant downstream impacts. After short thaw periods, discharge from the bottom of the reservoir tended to cause higher salt concentrations downstream in comparison with upstream sites. During long thaw periods or when large quantities of rain fell, downstream salt concentrations were considerably less than upstream values. Average chloride and sodium content of soil at the bottom of the reservoir more than doubled as a result of impounding runoff waters for one winter. (Visocky-ISWS)
W80-03468

PROXIMITY OF PIPELINES AND STORAGE FACILITIES FOR GAS AND OIL TO MAJOR AQUIFERS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03479

WATER-QUALITY DATA FOR LANDFILLS, HILLSBOROUGH COUNTY, FLORIDA, JANUARY 1974-OCTOBER 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, Jr., and R. R. Hallbourg.
Geological Survey open-file report 78-820, 1979. 112 p, 5 Fig, 6 Tab, 2 Ref.

Descriptors: *Water quality, *Landfills, *Water analysis, *Groundwater, *Florida, Data collections, Path of pollutants, Observation wells, Well data, Chemical analysis, Metals, Trace elements, Nitrogen, Phosphorus, Coliforms, Herbicides, Pesticides, Chemical oxygen demand, Biochemical oxygen demand, *Hillsborough County(Fla).

Periodic water-quality data were collected at four landfills in Hillsborough County, Florida, from January 1974 through October 1977. Water samples were analyzed for nitrogen and phosphorus species, cations, trace metals, chloride, specific conductance, chemical oxygen demand, biological oxygen demand, and coliforms. Select groundwater samples were analyzed for herbicide and pesticide. Results of chemical and bacteriological analysis from four landfills are presented as basic data. Geologic logs and well descriptions are presented for wells drilled at the landfills after January 1974. (Kosco-USGS)
W80-03489

IMPACTS OF COAL-FIRED POWER PLANTS ON FISH, WILDLIFE AND THEIR HABITATS,
Argonne National Lab., IL. Environmental Impact Studies.
For primary bibliographic entry see Field 4C.
W80-03518

DISTRIBUTION OF METALS IN STREET SWEEPINGS, STORMWATER SOLIDS, AND URBAN AQUATIC SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
W. G. Wilber, and J. V. Hunter.
Journal of the Water Pollution Control Federation, Vol 51, No 12, p 2810-2822, December 1979. 3 Fig, 8 Tab, 22 Ref. OWRT-A-050-NJ (4), 14-34-0001-9032.

Descriptors: *Heavy metals, *Urban runoff, *Stormwater, *Water pollution, *New Jersey, Sampling, Sediments, Metals, Rivers, Runoff, Solid wastes, Suspended solids, Cities, Chemicals, Chemical analysis, Water pollution sources, Path of pollutants, *Lodi(NJ), *Saddle River(NJ), Street sweepings, Non-point pollution.

The chemical availability of heavy metals in street sweepings, stormwater solids, and sediments from an urban area was determined based on their solubility in Saddle River (New Jersey) water, exchangeability with ammonium acetate, and association with easily reducible manganese oxides, organic matter, and moderately reducible iron oxides. An average of less than 1% of the total metals in the solids studied were soluble in Saddle River water at pH 7.4. The concentration of metals in street sweepings and stormwater solids exchangeable with NH40Ac (pH 7.0) was significant and, in the case of lead and zinc, comprised more than 20% of the total concentration. An average of 16.7% of the metals in the solids studied were bound to organic matter, with copper being the most tightly bound. With the exception of manganese and copper in sediments of the Saddle River, the fraction associated with moderately reducible iron oxides accounted for greater than 50% of the total metal concentrations. (Sims-ISWS)
W80-03543

INVESTIGATION OF SANITARY LANDFILL BEHAVIOR, VOLUME I. FINAL REPORT,
Drexel Univ., Philadelphia, PA.
A. A. Fungaroli, and R. L. Steiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-209 000, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-053a, July 1979. 330 p, 205 Fig, 33 Tab, 21 Ref, 1 Append. R800777 and R801947.

Descriptors: *Landfills, *Sanitary engineering, *Waste disposal, *Leachate, Infiltration, Soil chemistry, Percolation, Path of pollutants, Soil water, Subsurface drainage, Groundwater movement, Solid wastes, Gases, Wastes, Lysimeters.

A six year study of sanitary landfill behavior identified a semi-log linear relationship between contaminant concentration and leachate volume. An experimental sanitary landfill field site was monitored for gas generation, leachate migration, and groundwater contamination. The site was a 50 ft by 50 ft area with 11 ft of refuse covered by 2 ft of soil. Leachate quantity and pollution removal were recorded with a lysimeter in a laboratory sanitary landfill. At the field site accelerated column tests predicted long-term landfill behavior and identified the stabilization effects of depth and added nutrients. Various sizes of milled refuse were tested and the chemical components of leachates were correlated with each other and with leachate volume. Results were used to develop a two-dimensional model of leachate migration patterns. Good correlation was obtained from computer solutions and average field concentrations. Results show that once an entire landfill system is brought to field capacity the generation of leachate is in direct relationship to the volume of water added to the system. Leachate generation is dependent on initial moisture contents, landfill density, rate of filling, and water infiltration quantities. Leachate production is attributed to the refuse, channeling, an advance wetting front, or a main wetting front. Extensive conclusions are provided. (Seigler-IPA)
W80-03567

DISPOSAL OF DREDGED MATERIAL WITHIN THE NEW YORK DISTRICT: VOLUME I-PRESENT PRACTICES AND CANDIDATE ALTERNATIVES,
MITRE Corp., McLean, VA. METREK Div.
W. G. Conner, D. Aurand, M. Leslie, J. Slaughter, and A. Amr.
Performed for U.S. Army Corps of Engineers, New York District, May 1979. MITRE Technical Report MTR-7808. 360 p, 34 Fig, 59 Tab, 321 Ref, 5 Append. DACW51-C-77-0061.

Descriptors: *Dredging, *Waste disposal, *Management alternatives, *Ocean dumping, *Contaminants, *Disposal, *Dredged material, *New York, Land treatment, New York Bight, Chemical effects, Biological effects, Socioeconomic effects, Channels, Marine ecosystems, Federal Water Pollution Control Act Amendments, Borrow pits, Wetlands.

The two volumes of this report present results of a detailed evaluation of the dredged material ocean disposal program of the New York District of the U.S. Corps of Engineers. While there is clearly a need for continued dredging in the area, there are major environmental problems, mostly centered around the disposal of dredged material containing such contaminants as heavy metals, petroleum compounds, and synthetic organic compounds. Volume I examines the current program and its impacts in the New York Bight. Annual volumes of material dredged between 1970 and 1976 ranged from 8 to 19.5 million cubic yards. Area conditions which might signify environmental degradation include low water bottom oxygen content, declining commercial fish harvests, and increased incidence of fish diseases and kills. Continued dumping of dredged material and the current Mud Dump disposal site would probably directly affect only a relatively small area of the bottom. Alternatives were sorted into three categories: not currently reasonable, possible in special cases, and possible in special cases and feasible for larger volumes of dredged material. Three alternatives were placed in the third category and are most likely to provide acceptable disposal in the area: shallow ocean disposal, subaqueous borrow pits, and confined upland disposal. Open ocean disposal is recommended only as a last alternative. Measures to reduce the volume of dredged material include selective dredging and sediment control. (Arnold-NC)
W80-03586

MEASUREMENTS OF VERTICAL FLOW IN GROUND WATER BORINGS AND HYDROLOGICAL PARAMETERS FOR ASSESSING GROUND WATER POLLUTION,
Bhabha Atomic Research Centre, Bombay (India).
U. Chandra.
Mausam, Vol 30, No 1, p 3-8, January 1979. 8 Fig, 14 Ref.

Descriptors: *Groundwater, *Boreholes, *Groundwater movement, *Water pollution, On-site investigations, Flow, Aquifers, Water pollution sources, Equipment, Instrumentation, Rivers, Garbage dumps, Industrial wastes, Hydrology, Path of pollutants, Vertical groundwater flow.

Some measurements of vertical flow in borings in karst dolomite aquifer by the use of an electromechanical device were reported. Field studies undertaken to assess groundwater pollution due to releases from a refinery complex, garbage disposal site, and a heavily polluted river were described. (Sims-ISWS)
W80-03599

5C. Effects Of Pollution

A STUDY OF THE CHARACTERISTICS AND POLLUTION POTENTIAL OF LAND SPREAD DOMESTIC SEPTAGE ON GROUNDWATER QUALITY,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-03306

THE KILLING OF RUSH CREEK,
Minnesota Department of Natural Resources, Rochester.
J. A. Schneider.
Water Spectrum, Vol 12, No 1, p 38-43, Winter 1979, 9 Fig.

Descriptors: *Fishkill, *Pesticide toxicity, *Minnesota, *Agricultural runoff, Surface runoff, Trout, Suckers, Turbidity, Water temperature, Dissolved oxygen, Ammonia, Water pollution effects, Erosion control, Wet seasons, Rainfall, Cholinesterase inhibition.

The May 20, 1978 fishkill along 13 miles of Rush Creek in Minnesota and other similar fishkills prompted a full scale investigation into the causes for the deaths. A common factor involved in all of the kills seemed to be rainfall heavy enough to cause washing and erosion from row crop fields. The most severe kills occurred during the May planting season every year. To pursue the theory that agricultural chemicals were causing the kills a staff of trained and experienced people from several agencies were assembled including the Extension Service, the Environmental Protection Agency, The Federal Fish and Wildlife Service, and the Minnesota Department of Natural Resources. A sampling program was designed that could be rapidly implemented the following year during May if the fishkills were repeated. Sampling procedures selected included: tests for pH, temperature, turbidity, ammonia, and dissolved oxygen; and a simple field test for detecting cholinesterase inhibition. Fishkills did occur in May and June and samples of moribund and freshly killed suckers were tested. The cholinesterase inhibition test gave excellent results indicating death due to poisoning probably from organo-phosphate-based insecticides for controlling corn rootworm larvae. Better farming practices to control erosion and runoff are needed to help prevent future kills. (Seigler-IPA)
W80-03318

LABORATORY OBSERVATIONS ON THE INFLUENCE OF TEMPERATURE AND SALINITY ON DEVELOPMENT OF THE EGGS AND GROWTH OF THE LARVAE OF SOLEA SOLEA (PISCES),

Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5A.
W80-03329

RESPONSES OF THE FISH BLENNIUS PHOLIS TO FLUCTUATING SALINITIES,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
For primary bibliographic entry see Field 5A.
W80-03330

ACCUMULATION, ELIMINATION, AND METABOLISM OF DICHLOROBENZIDINE IN THE BLUEGILL SUNFISH,
Syracuse Research Corp., NY. Life Sciences Div.
For primary bibliographic entry see Field 5B.
W80-03334

EVALUATION OF CUTRINE FOR USE IN FISH CULTURE,
New York State Dept. of Environmental Conservation, Rome.
For primary bibliographic entry see Field 5A.
W80-03335

FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS--IV THE TOXICITY OF MIXTURES OF OIL PRODUCTS AND OIL-SPILL EMULSIFIERS TO PHYTOPLANKTON (IN JAPANESE),
Tokyo Univ. (Japan). Dept. of Fisheries.
H. Tokuda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 10, p 1289-1291, 1979. 3 Tab, 6 Ref, (English Abst).

Descriptors: *Oil pollution, *Toxicity, *Diatoms, Oil, Oil spills, Fuels, Emulsifiers, Chemical properties, Growth rates, Aquatic algae, Phytoplankton, *Dispersants, *Oil dispersants.

The toxicity of mixtures of several oil products and oil-spill emulsifiers to the growth of a marine diatom Skeletonema costatum was compared with that of individual oil products and oil-spill emulsifiers. The following results were obtained: the toxicity of all the mixtures tested is by far higher than that of individual oil-spill emulsifiers, but is similar to or slightly higher than that of the corresponding individual oil products. (Deal-EIS)
W80-03338

INHIBITION OF CARBON FIXATION AS A FUNCTION OF ZINC UPTAKE IN NATURAL PHYTOPLANKTON ASSEMBLAGES,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5A.
W80-03340

COLD SHOCK: EFFECT OF RATE OF THERMAL DECREASE ON ATLANTIC MENHADEN,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, P. R. Abell, and T. P. Capizzi.
Marine Pollution Bulletin, Vol 10, p 347-349, 1979. 1 Fig, 1 Tab, 19 Ref.

Descriptors: *Thermal stress, *Powerplants, *Fish physiology, Mortality, Water temperature, Juvenile growth stage, Regression analysis, Mathematical models, Cold resistance, Fish behavior, *Atlantic menhaden, *Acclimation.

This study was designed to assess the effects of various rates of thermal decrease on mortality of juvenile Atlantic menhaden (Brevoortia tyrannus) which may result from winter shutdown of large power plant facilities. Temperatures were lowered from 15 to 5C at rates of decrease which ranged from 27.0 to 0.4/hr. A significant correlation was found between rate of thermal decrease and mortality. The relationship between percent mortality and rate of decrease was best described by a piecewise regression curve with two rates; one rate where mortality was high and a second where mortality decreased rapidly as the rate of temperature reduction decreased. (Deal-EIS)
W80-03344

EUGLENACEA AND CHRYSOPHYCEAE AS ORGANISMS INVOLVED IN POLLUTION OF THE MARINE LITTORAL (IN FRENCH),
Institut Romania de Recherces Marines, Constantsa.
For primary bibliographic entry see Field 5A.
W80-03345

MEIOFAUNA DEVELOPMENT ON ARTIFICIAL SOFT BOTTOMS IN KIEL BAY (IN GERMAN),
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
For primary bibliographic entry see Field 5A.
W80-03346

PHOSPHORUS RECYCLE AND CHLOROPHYLL IN THE GREAT LAKES,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. Di Toro, and W. F. Matystik.
Journal of Great Lakes Research, Vol 5, No 3-4, p 233-245, 1979. 6 Fig, 2 Tab, 21 Ref.

Descriptors: *Great Lakes, *Lake Erie, *Lake Huron, *Lake Ontario, *Phosphorus, *Cycling nutrients, Eutrophication, Chlorophyll, Phytoplankton, Aquatic life, Algae, Kinetics, Limnology, Productivity, Water pollution effects.

A model of the kinetics of phosphorus recycling rates and their relationship to chlorophyll a concentrations and phytoplankton populations was developed for Lake Huron, Lake Ontario, Saginaw Bay, and other Great Lakes areas. To simply theoretically characterize, the recycling process nutrients are divided into three forms: plankton-bound, available, and unavailable. From these divisions a kinetic formulation for the recycling is developed. These formulations indicate a decline in the ratio of unavailable to total phosphorus with increasing chlorophyll a concentrations. This simple theoretical analysis with steady state and constant parameters is applied to long time average epilimnion data for areas in Lake Erie, Lake Huron, Lake Ontario, and Saginaw Bay. Results from this application suggest an inverse relationship between the unavailable portion of both total and soluble phosphorus and chlorophyll. Assumptions that the phosphorus recycling rate is a saturating function of chlorophyll produce consistent agreement with the same phytoplankton and recycle kinetic constants. Computations for Lake Huron illustrate that for the lower range of chlorophyll concentrations percentage increases in phosphorus discharge are larger than strictly proportional increases in chlorophyll. For Lake Huron a two-fold increase in phosphorus loading produces approximately a four-fold algal chlorophyll increase. (Seigler-IPA)
W80-03388

RESPONSES OF FRESHWATER BENTHOS TO OPEN-LAKE DREDGED SPOILS DISPOSAL IN LAKE ERIE,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
R. W. Flint.
Journal of Great Lakes Research, Vol 5, No 3-4, p 264-275, 1979. 5 Fig, 4 Tab, 21 Ref.

Descriptors: *Lake Erie, *Dredging, *Disposal, *Benthic fauna, Bottom sediments, Sands, Mud, Water sampling, Oligochaetes, Invertebrates, Benthos, Aquatic populations, Distribution patterns, Environmental effects, Worms, Larvae.

Temporal variations in the natural benthic macroinvertebrate community of areas subjected to open-lake dredged spoil disposal were examined in Lake Erie near Ashtabula. The two types of dredged spoil used were sandy-silt sediment from the Ashtabula harbor and coarser sand sediments from the Ashtabula River. Two untreated reference sites were also sampled for comparison. Ponar grab samples were used to characterize the communities at the sources of dredging to determine the types of material that would be deposited at the spoil sites. Samples were taken at the disposal and control sites at intervals of 5 days, 90 days, 256 days, and 340 days after disposal. For each sample taken a modified Spade box corer was used to collect four replicate bottom samples. Macroinvertebrates were identified to the lowest taxa possible. Results show that for the sandy silt site the density of macroinvertebrates increased while diversity decreased. Species brought in with the river and harbor sediments contributed to the increased density. Also while the untreated sites had communities of 60 to 80% oligochaetes both disposal sites had communities of 98% oligochaetes. The river spoils disposal sites showed a more rapid recovery to predisposal conditions. The opportunistic nature of the Oligochaeta life history patterns allows them to take advantage of and thrive in the environment existing after disposal. This dominance of Oligochaeta along with the increased population density form unstable communities at the disposal sites. (Seigler-IPA)
W80-03391

A SELECTED BIBLIOGRAPHY OF THE LIFE REQUIREMENTS OF COLONIAL NESTING WATERBIRDS AND THEIR RELATIONSHIP TO DREDGED MATERIAL ISLANDS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. C. Landin.
Miscellaneous Paper D-78-5, September 1978. 52 p.

Descriptors: *Birds, *Bibliographies, *Water birds, Islands, Environmental effects, Dredging, *Dredged material, *Colonial birds.

An extensive bibliography of pertinent research on the life requirements of colonial nesting waterbirds in the United States and their relationship to dredged material. An additional bibliography of 181 references pertaining to the vegetation and soils on dredged material islands and environmental impacts of dredged material deposition on waterbird habitats is also presented. Selected references from Canada, Europe, and Africa that pertain to related waterbirds or those introduced to the United States are included. This report provides the reader access to little-known sources and gives localized data on waterbird species that are not otherwise readily available. References from years 1844 to 1978 are included. (WES)
W80-03393

EVALUATION OF DREDGED MATERIAL POLLUTION POTENTIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. M. Brannon.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A059 724, Price codes: A03 in paper copy, A01 in microfiche. Technical Report DS-78-6, August 1978. 39 p, 36 Ref.

Descriptors: *Aquatic environment, *Water pollution, *Dredging, *Wastes, Forecasting, Environmental effects, Water quality, Benthos, *Dredged material.

Synthesizes data from seven research projects that investigated pollution properties of dredged material and procedures for determining their potential for effect on water quality and aquatic organisms. Short-term impact of dredged material on water quality and aquatic organisms is related to the concentration of chemically mobile, readily available contaminants rather than total concentration. The Elutriate Test, which measures concentrations of contaminants released from dredged material, can be used to evaluate short-term impacts on water quality. The only constituents generally released from dredged material are manganese and ammonium -N. Elevated concentrations of these constituents, however, are of short duration because of rapid mixing and are of low frequency due to the intermittent nature of most disposal operations. Short-term chemical and biological impacts of dredging and disposal have generally been minimal. Longer term impacts of dredged material on

water quality have generally been slight and can be evaluated by means of the Elutriate Test and analysis of mobile forms of sediment contaminants. The greatest hazard of dredged material disposal is the potential effect of material on benthic organisms. Most dredged material has not proven particularly toxic. Some dredged material, however, can be extremely toxic or of unknown toxicological character. (WES)
W80-03395

EFFECTS OF ORGANIC COMPOUNDS ON AMPHIBIAN REPRODUCTION,
Kentucky Water Resources Research Inst., Lexington.
J. Birge, A. Black, and A. Kuehne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147523, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 121, 1980. 45 p, 3 Fig, 5 Tab, 44 Ref. OWRT A-074-KY(2), 14-34-0001-7038.

Descriptors: Water quality, *Organic compounds, Phenols, *Amphibians, Reproduction, Toxicity, Lethal limit, *Water pollution effects, Embryo-Larval tests, Atrazine, Carbon Tetrachloride, Chloroform, Methylene chloride.

Aquatic toxicity tests were conducted with atrazine, carbon tetrachloride, chloroform, methylene chloride, trisodium nitrilotriacetic acid (NTA), and phenol. Each compound was administered to developmental stages of three to five amphibian species. Exposure was initiated at fertilization and maintained through 4 days post-hatching. Test responses included lethality and teratogenesis. Different amphibian species exhibited varying degrees of tolerance to the selected compounds. Greatest tolerance usually was observed for the more broadly adapted semi-aquatic and terrestrial species (e.g., Bufo americanus, Bufo fowleri). The more sensitive amphibians usually included those species which normally are restricted to aquatic or moist habitats (e.g., Rana catesbeiana, Rana pipiens). Median lethal concentrations (mg/l) determined at 4 days posthatching ranged from 0.41 to 48 for atrazine, 0.90 to 2.83 for carbon tetrachloride, 0.27 to 35.14 for chloroform, 17.78 to>32 for methylene chloride, 39.3 to 252.3 for NTA, and 0.04 to>0.89 for phenol. The most toxic compounds always included phenol, carbon tetrachloride, and atrazine, and the least toxic consistently were NTA and methylene chloride. For three chlorinated alkanes, including methylene chloride, chloroform, and carbon tetrachloride, toxicity increased with chlorination. Toxicity of the different compounds was further characterized by calculating concentrations which produced embryo-larval lethality or teratogenesis at frequencies of 10% and 1%. (Huffsey-Ky)
W80-03438

LONGEVITY AND REPRODUCTION OF DAPHNIA PULEX (DE GEER) EXPOSED TO CADMIUM-CONTAMINATED FOOD OR WATER,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 5A.
W80-03439

ALGAL AND INVERTEBRATE COMMUNITIES IN THREE SUBARCTIC LAKES RECEIVING MINE WASTES,
J. W. Moore, D. J. Sutherland, and V. A. Beaubien.
Water Research, Vol 13, No 12, p 1193-1202, 1979. 4 Fig, 4 Tab, 28 Ref.

Descriptors: *Lakes, *Water pollution, *Biological communities, *Canada, Mine wastes, Metals, Chemicals, Pollutants, Arsenic, Lead, Copper, Heavy metals, Hardness(Water), Phytoplankton, Zooplankton, Algae, Daphnia, Biota, Sampling, Chemical analysis, Subarctic, Limnology, Biology, Cyanide.

The effects of liquid mine wastes on the density, species composition, and diversity of phytoplankton and zooplankton were determined between May 1977 and May 1978 in a series of three small, shallow lakes (Meg, Keg, Peg Lakes) situated in the Canadian subarctic. The concentrations of the most common toxicants fluctuated widely during the study in each of the lakes. Meg Lake was the most polluted, with the concentrations of arsenic, lead, cyanide, and copper reaching 3.0, 0.65, 0.60, and 0.65 g/cu m, respectively. Although the levels of arsenic and lead in the other two lakes were roughly similar to those recorded in Meg Lake, cyanide and copper usually fell below detectable limits. Overall, changes in the level of contamination were poorly correlated with variations in the abundance of the flora and fauna. While phytoplankton (Chlamydomonas lapponica, Aphanotheece microspora) were common in Meg Lake, reaching densities of 200 mg/cu m, zooplankton were either rare or absent. Algal popu lations in Keg and Peg Lakes, which were dominated by Chlamydomonas lapponica and Oocystis parva, attained maximum densities of 200 and 150 mg/cu m, respectively. The most common zooplankter, Keratella quadrata, maintained populations of up to 20000-40000 animals/cu m, and was followed in abundance by Daphnia middendorfiana and Cyclops bicuspidatus thomasi. It was concluded that: (1) the prevalent species may have developed a resistance to metals; (2) taxa not previously associated with heavy metal contamination may have the ability to adapt to pollution; and (3) high arsenic and lead levels probably had less impact on zooplankton than on phytoplankton under field conditions. (Sims-ISWS)
W80-03457

THE EFFECT OF WASTEWATER PHOSPHORUS REMOVAL ON SHAGAWA LAKE, MINNESOTA: PHOSPHORUS SUPPLIES, LAKE PHOSPHORUS AND CHLOROPHYLL A,
Corvallis Environmental Research Lab., OR.
D. P. Larsen, J. Van Sickle, K. W. Malueg, and P. D. Smith.
Water Research, Vol 13, No 12, p 1259-1272, 1979. 8 Fig, 9 Tab, 48 Ref.

Descriptors: *Water pollution effects, *Lakes, *Phosphorus, *Chlorophyll, *Minnesota, Water pollution, Water pollution control, Sewage treatment, Water quality control, Algae, Nutrients, Pollutants, Pollutant identification, Phosphorus compounds, Sampling, Chemical analysis, Limnology, *Shagawa Lake(MN).

In early 1973, the phosphorus supply to Shagawa Lake, Minnesota, was reduced by about 80% when a tertiary wastewater treatment plant began operating. Significant reductions in total and soluble reactive phosphorus concentrations have occurred in the lake since that time. By 1976 the average (volume weighted over the entire lake) total and soluble reactive phosphorus concentrations had declined from about 51 and 21 micrograms/liter to about 30 and 4.5 micrograms/liter, respectively, corresponding to 40 and 80% reductions. During 1975 and 1976, chlorophyll a (averaged over the top 5 m) had decreased to less than 50% of the pretreatment level during May-June, but during July-August little change had occurred. A phosphorus residence time model projected equilibrium total phosphorus concentrations of about 12 micrograms/liter within 1.5 years. The fact that this level was not reached was attributed to a feedback of phosphorus from the sediments, primarily during summer. This phenomenon was incorporated into a modified total phosphorus mass balance model which projects the phosphorus pattern through 1976 quite accurately. The close fit of the modified mass balance model implies that the phosphorus supply from the sediments has not diminished since treatment began, and that further recovery of the lake will depend upon how long this feedback of phosphorus from the sediments continues. (Sims-ISWS)
W80-03459

EFFECTS OF LIMESTONE STRIP MINING ON BENTHIC MACROINVERTEBRATE COMMUNITIES,
Calgary Univ. (Alberta). Dept. of Biology.
L. L. Osborne, R. W. Davies, and K. J. Linton.
Water Research, Vol 13, No 12, p 1285-1290, 1979. 1 Fig, 4 Tab, 23 Ref, 1 Append.

Descriptors: *Strip mines, *Limestones, *Water pollution effects, *Invertebrates, *Pennsylvania, Mine wastes, Mine acids, Alkalinity, Hydrogen ion concentration, Biota, Biological communities, Rivers, Sampling, Pollutants, Iron compounds, Water chemistry, Larvae, Biology, Buffering.

The changes in water quality and benthic macroinvertebrate community structure and composition related to limestone strip mining in western Pennsylvania were recorded and compared to the recorded effects of coal strip mining. In contrast to coal strip mining characterized by high total acidity and iron concentrations with decreased total alkalinity and pH, limestone strip mining showed only a slight increase in total acidity and bicarbonate alkalinity, and no increase in iron concentration due to the formation of heavy deposits of ferric hydroxide. The sulfate concentration and conductance increased with both coal and limestone strip mining. Limestone strip mining did not result in the extreme deterioration of benthic community structure and composition reported with coal strip mining. The decreased species diversity recorded was directly correlated with the sulfate concentrations and resulted from changes in species abundance rather than species composition. The changes in species abundance appear to be related to changes in food resource availability due to the deposition of ferric hydroxide on the detritus. (Sims-ISWS)
W80-03460

EFFECT OF SEDIMENT CONTROL DAMS ON THE WATER QUALITY OF A PRAIRIE LAKE,
South Dakota State Univ. Dept. of Biology.
For primary bibliographic entry see Field 4D.
W80-03477

DRAINAGE AND LARVICIDING FOR CONTROL OF A MALARIA FOCUS IN HAITI,
World Health Organization, Washington, DC. Malaria Eradication Dept.
For primary bibliographic entry see Field 4C.
W80-03505

IMPACTS OF COAL-FIRED POWER PLANTS ON FISH, WILDLIFE AND THEIR HABITATS,
Argonne National Lab., IL. Environmental Impact Studies.
For primary bibliographic entry see Field 4C.
W80-03518

DISTRIBUTION, ABUNDANCE, AND PETROLEUM-DEGRADING POTENTIAL OF MARINE BACTERIA FROM MIDDLE ATLANTIC CONTINENTAL SHELF WATERS,
Virginia Inst. of Marine Science, Gloucester Point. Dept. of Microbiology-Pathology.
A. E. Maccubbin, and H. Kator.
In: Proceedings of the Workshop: Microbial Degradation of Pollutants in Marine Environments, Pensacola Beach, Florida, 9-14 April 1978, U.S. Environmental Protection Agency, Miscellaneous Reports Series, No EPA-600/9-79-012, p 380-395, April 1979. 6 Fig, 8 Tab, 15 Ref.

Descriptors: *Bacteria, *Organic compounds, *Oil pollution, *Microbial degradation, *Water pollution effects, Environmental effects, Seasonal, Baseline studies, Resources development, Oil spills, *Outer Continental Shelf, Middle Atlantic, Crude oil.

Bacterial populations indigenous to surface (1 m) waters of the Middle Atlantic Continental Shelf were sampled at seasonal intervals to determine the abundance and distribution of petroleum-degrading (HC), chitinoclastic, and 'total' heterotrophic (HET) bacteria. Simultaneously, unweathered South Louisiana crude oil was added to aliquots of 1-m water samples to evaluate rates and patterns of saturated paraffin degradation on shipboard under controlled incubation conditions. Degradation was examined under selected nutrient and temperature regimes in both closed flasks and prototype 'open' or continuous dilution systems. HET bacterial

levels generally decreased with distance from land. HC bacteria were most abundant in the coastal boundary layer. Changes in values of HC/HET tended to be directly related to the abundance of petroleum-degrading bacteria. Degradation of saturated paraffins in closed flasks characteristically resulted in removal of n-alkanes and isoprenoids at rates related to season, sampling location, and nutrient regime. (Sinha-OEIS)
W80-03538

EFFECTS OF SUBLETHAL OIL CONCENTRATIONS ON THE COPEPOD, NITOCRA AFFINIS,
North Carolina State Univ. at Raleigh.
J. F. Ustach.
Estuaries, Vol 2, No 4, p 273-276, December 1979. 1 Tab, 30 Ref.

Descriptors: *Oil pollution, *Copepods, *Water pollution effects, Oil spills, Environmental effects, Resources development, Baseline studies, *Outer Continental Shelf, Nitocra affinis, Crude oil, Sublethal effects.

The water soluble fraction from 200 micro 1 Louisiana crude oil per liter of filtered sea water and of the one-half and three-quarter dilutions of the oiled water with filtered sea water caused a reduction in brood size of the harpacticoid copepod, Nitocra affinis. The mean (or - standard error) brood size of the control was 14.41 or - 1.09 while those of the animals exposed to the undiluted, one-half, and three-quarter dilutions were 8.37 or - 1.78, 8.44 or - 1.25, and 8.35 or - 1.63, respectively. There were no statistically significant differences among the mean lengths of life spans or among the mean frequencies of broods produced. (Sinha-OEIS)
W80-03540

ENZYME ACTIVITIES FOLLOWING CHRONIC EXPOSURE TO CRUDE OIL IN A SIMULATED ECOSYSTEM. I: AMERICAN OYSTERS AND BROWN SHRIMP,
Mississippi State Univ., Mississippi State.
J. E. Chambers, J. R. Heitz, F. M. McCorkle, and J. D. Yarbrough.
Environmental Research, Vol 20, No 1, p 133-139, October 1979. 6 Tab, 10 Ref.

Descriptors: *Oil pollution, *Ecosystems, *Oysters, *Shrimp, *Enzymes, Oil spills, Resources development, Water pollution effects, Environmental effects, Baseline studies, Seasonal, *Outer Continental Shelf, Crassostrea virginica, Penaeus sp.

Enzyme activities were investigated in whole-body homogenates from oysters and hepatopancreas homogenates from shrimp which had been exposed to crude oil for 8 months in a simulated estuarine ecosystem. Enzymes assayed included acetylcholinesterase, alkaline phosphatase, Beta-glucuronidase, glutamic-pyruvic transaminase, lactic dehydrogenase, and malic dehydrogenase. Few seasonal trends in enzyme activity were observed in either species. Several alterations in enzyme activity were noted in oil-treated shrimp and oysters 6-8 months following the oil spill when the animals were stressed and may reflect physiological changes in animals which are severely stressed. However, few chronic alterations in enzyme activity were observed which could be attributed to the oil spill. (See also W80-03542) (Sinha-OEIS)
W80-03541

ENZYME ACTIVITIES FOLLOWING CHRONIC EXPOSURE TO CRUDE OIL IN A SIMULATED ECOSYSTEM. II: STRIPED MULLET,
Mississippi State Univ., Mississippi State.
J. E. Chambers, J. R. Heitz, F. M. McCorkle, and J. D. Yarbrough.
Environmental Research, Vol 20, No 1, p 140-147, October 1979. 5 Tab, 6 Ref.

Descriptors: *Enzymes, *Fish, *Oil pollution, *Water pollution effects, Estuaries, Ecosystems, Oil spills, Resources development, Baseline studies, Environmental effects, Seasonal, Gulf of Mexico, *Outer Continental Shelf, Mugil cephalus.

Enzyme activities were investigated in brain, gill, liver, and muscle homogenates from striped mullet which had been exposed to crude oil for 10 months in a simulated estuarine ecosystem. Enzymes assayed included acetylcholinesterase, alkaline phosphatase, Beta-glucuronidase, glutamic-pyruvic transaminase, lactic dehydrogenase, and malic dehydrogenase. Few seasonal trends in enzyme activities were observed. Alterations in some enzyme activities, particularly acetylcholinesterase, Beta-glucuronidase, and malic dehydrogenase, may have reflected physiological changes in the mullet resulting from stress. In general, there were few chronic alterations in mullet enzyme activities resulting from the oil spill. (See also W80-03541) (Sinha-OEIS)
W80-03542

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VIII-APPENDIX G, FISH AND WILDLIFE RESOURCES.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03574

5D. Waste Treatment Processes

PROCESS FOR SOLUBLE CYANIDE REMOVAL FROM WASTEWATER STREAMS,
Ciba-Geigy Corp., Ardsley, NY. (Assignee).
Y. S. Sury, and M. J. Guillory, Jr.
US Patent No 4,176,060, 4 p, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1050, November 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, Chlorination, Acidity, Temperature, Chemical reactions, Cyanide.

The object of this invention is to provide a process for substantially destroying the soluble cyanide complex content of industrial wastewater streams. By conducting a hot acid chlorination technique, the soluble cyanide complex content of industrial wastewater streams can be reduced to a level below about 1 ppm. Thus, by contacting the wastewater at a temperature in excess of about 80C, and preferably in excess of about 95C, with sufficient mineral acid such as hydrochloric, sulfuric, nitric, phosphoric, and the like to provide a pH level below about 3.0 and with additional chlorine, rapid, efficient, complete reduction of the soluble cyanide complex is achieved. (Sinha-OEIS)
W80-03362

A STUDY OF THE APPLICABILITY OF BATCH REACTOR WASHWATER TREATMENT FOR AREAS OF INTERMITTENT LOADING,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. E. Alleman, and J. S. Colt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147507, Price codes: A04 in paper copy, A01 in microfiche. University of Maryland Water Resources Research Center Technical Report No 55, Nov 1979. 68 p, 36 Fig, 2 Tab, 10 Ref. OWRT A-049-MD (1), 14-34-0001-9022.

Descriptors: *Sewage treatment, *Waste water treatment, *Batch waste water treatment, Aeration, Septic tanks, Waste treatment, Water treatment, Parks, Recreation facilities, Oxidation lagoons, On-site investigations, Discharge(Water), Influent streams, Inflow, Infiltration.

Seven waste water treatment facilities at Maryland state parks were examined and evaluated on the basis of system design, influent characteristics, and overall performance. Five of the plants are extended-areation systems; one is a septic tank/filtration gallery; one is an oxidation pond with subsequent sand filtration. Unit capabilities ranged from 50,000-250,000 gallons per day; influent flows varied considerably in rate and strength. Influent depended primarily on plant location, park usage, and season of the year. All plants were operated twelve months of the year and plant discharge during the winter was comprised of inflow and infiltration, and/or clean water used with chlorine injector units. Plants were shown to be vastly overdesigned, and hence there was an inadequacy of sufficient waste water organics necessary to maintain a desirable activated-sludge population. Dog food is added to several plants' influent stream to augment the lack of waste water organics. Batch treatment is recommended and two batch systems are proposed. Back-up low-flow systems are proposed for slow seasons. Connection of adjacent housing developments to existing park facilities is suggested. Consideration should be given to the renovation of plants, and their operation as intermittent discharge systems. (Schaefer-IPA)
W80-03383

U.S. CORPORATE RESPONSE TO ENVIRONMENTAL OBJECTIVES,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
For primary bibliographic entry see Field 6E.
W80-03412

METHOD AND APPARATUS FOR RECOVERING LIQUID AND SOLID CONSTITUENTS OF WATER SOLUTIONS CONTAINING SPARINGLY SOLUBLE SOLIDS,
Environmental Systems, Inc., El Paso, TX. (Assignee).
R. T. Wheatley, and L. J. Kosarek.
US Patent No 4,176,057, 10 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1048, November 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water purification, Industrial wastes, Separation techniques, Reverse osmosis, Chemical reactions, Suspended solids, Powerplants, Industrial plants, Product recovery, Closed loop system.

This invention relates to a method and apparatus for separating aqueous solutions containing sparingly soluble solids into useable constituents including the purifying of waste waters from industrial and power plants so that the plants may operate with a capability of a zero polluted effluent discharge and yet require only the disposal of a very small volume of sludge which in many instances may have a by-product value. Specifically, the invention provides a closed loop system for the recovery of water and solids from hydrometallurgical solutions, effluent of industrial and power plants and the like while the closed loop system only requires a low input of energy, utilizes reverse osmosis technology, chemically treats the brine effluent to reduce soluble constitutents to prevent fouling of the reverse osmosis membrane, reintroduced the water content of the brine effluent back into the system for zero or minimal discharge of effluent and yields small easily handled volumes of substantially solid sludge which may have sufficient fertilizer or recoverable metal value to warrant processing. (Sinha-OEIS)
W80-03414

WATER PURIFICATION METHOD AND APPARATUS,
Westinghouse Electric Corp., Pittsburgh, PA. (Assignee).
K. Moeglich.
US Patent No 4,176,038, 12 p, 14 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1043, November 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Electrolysis, Turbulence, Electrodes, Alternating current, Coagulation, Scaling, Equipment, Separation techniques, Fluidized bed.

An improved method and apparatus for continuously agglomerating solids of colloidal size or larger suspended in a liquid is disclosed. The process comprises passing the liquid between spaced electrode plates in the presence of a fluidized bed of conductive particles, and subjecting the liquid suspension to an electric field from alternating

current applied across the electrodes through the conductive particles. The turbulence of the particles in the bed has been found to improve conductivity and current efficiency, minimize electrode erosion, and by a mechanical, scrubbing action of the bed particles, minimize fouling or scaling of the electrodes so that the suspending forces of the solids are rapidly and efficiently broken. The agglomerated solids may then be separated from the liquid by conventional means such as skimming, settling, flotation and the like. (Sinha-OEIS)
W80-03426

HYDROLOGIC DATA FROM A DEEP TEST WELL, CITY OF SARASOTA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Sutcliffe, Jr.
Available from OFSS U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225, Price codes: $3.50 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1275, 1979. 23 p, 2 Fig, 5 Tab, 2 Ref.

Descriptors: *Hydrologic data, *Injection wells, *Rotary drilling, *Waste disposal, *Liquid wastes, Test wells, Treatment facilities, Water analysis, Sampling, Chlorides, Aquifer characteristics, Water quality, Petrology, Chemical analysis, Trace elements, Florida, *Sarasota(Fla), Conventional circulation mud-rotary drilling method, Reverse circulation air-lift drilling method.

The city of Sarasota drilled a test well to a depth of 3,513 feet at the city's wastewater-treatment facility in downtown Sarasota, Fla. The test well was drilled to determine the feasibility of disposing of liquid waste from the city's secondary treatment plant. Drilling of the test well began in July 1973 and was completed in November 1974. A conventional circulation mud-rotary drilling method was used to a depth of 1,146 feet below land surface and a reverse circulation air-lift method was used to a depth of 3,513 feet. The greatest chloride concentration of water withdrawn from the test well was 31,000 milligrams per liter. The test well, uncased and open to dolomitic limestone between 2,006 and 3,513 feet, yielded 392 gallons per minute with a drawdown of approximately 100 feet. (Kosco-USGS)
W80-03482

PURIFICATION OF WASTE STREAMS CONTAINING AVAILABLE CHLORINE,
Olin Corp. New Haven, CT. (Assignee).
W. J. Sakowski.
U.S. Patent No 4,175,038, 4 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 988, No 3, p 699, November 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Chemical wastes, Chlorine, Chemical reactions, Chlorination, Temperature, Activated carbon.

A process is disclosed for reducing the available chlorine content of aqueous waste streams produced in chemical plants, especially calcium hypochlorite plants, in order to permit further purification treatment in waste purification systems which employ activated carbon. The available chlorine content is reduced by chlorinating the impure stream at a temperature in the range from about 80 to 100C at a pH in the range from about 5.5 to about 8.5. In order to avoid excessive reactor boilover, close control of these conditions is required. In addition the reaction is time dependent and the holup time in the reactor and a subsequent hold tank ranges from about 0.5 to about 4 hours. During this reaction the available chlorine forms the corresponding chlorate in the aqueous solution which may be passed through the activated carbon bed without adversely affecting the bed operation. (Sinha-OEIS)
W80-03539

OXIDATION PROCESS,
Sterling Drug Inc., New York. (Assignee).
L. A. Pradt, and W. B. Gitchel.
U.S. Patent No 4,174,280, 4 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 988, No 2, p 435, November 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Waste treatment, Industrial wastes, Oil pollution, Oxidation, Heat exchangers, Recycling, Explosives, Wet oxidation process, Product recovery, Petroleum products.

The invention comprises a process for oxidizing by wet air oxidation an oxidizable material which is insoluble, immiscible and difficult to suspend or emulsify in water. The process comprises injecting the material directly into a sealed reactor containing an aqueous medium supplied with an oxygen-containing gas, oxidizing the material at a temperature and pressure sufficient to provide controlled autogenic and self-sustaining reaction, to produce an oxidized effluent which is removed from the reactor. Materials especially adapted to oxidation by this process are petroleum products, motor oils, diesel fuel, explosives, and propellants. The invention can be employed in connection with any known application of wet air oxidation systems, including those designed for waste disposal, for byproduct or chemical recovery or for generation of useful energy. (Sinha-OEIS)
W80-03591

SLUDGE THICKENING APPARATUS AND PROCESS,
Envirotech Corp., Menlo Park, CA. (Assignee).
E. M. Kelly.
U.S. Patent No 4,173,534, 8 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 176-177, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Sludge treatment, Industrial wastes, Domestic wastes, Activated sludge, Anaerobic digestion, Equipment, Sludge thickening.

A wastewater treatment system of the activated sludge type includes a primary clarifier, a biological treatment unit and a secondary clarifier. The object of the invention is to provide means for concomitantly thickening primary and secondary sludge. In addition improved means are provided for inhibiting anaerobic decomposition of the primary sludge while it is being thickened. The apparatus comprises a tank having upper and lower feedwells. Primary sludge is introduced into the lower feedwell and flows into the lower part of the tank to thicken. Secondary sludge is aerated and introduced into the upper feedwell so that it flows from and thickens in the upper part of the tank by flotation type thickening. (Sinha-OEIS)
W80-03596

5E. Ultimate Disposal Of Wastes

PROCESSES AFFECTING THE FATE OF DREDGED MATERIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
B. W. Holliday.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A059 276, Price codes: A03 in paper copy, A01 in microfiche. Technical Report DS-78-2, August 1978. 32 p, 36 Ref.

Descriptors: *Environmental effects, *Waste disposal, Oceans, Estuaries, Rivers, Lakes, *Dredged material, *Dredged material disposal.

Determination of the fate of dredged material placed on the bottom of an ocean, lake, estuary, or river is an environmental concern that requires consideration and adequate prediction in the planning of a dredging project, since various natural processes can alter the initial configuration of the deposit and subject the surrounding bottom to some level of environmental impact. In the selection process for a disposal site, consideration must be given to the eventual disposition of dredged material in order that adequate determination of the site capacity can be made. The four primary environments that may contain subaqueous dredged material deposits are oceans, estuaries, rivers, and lakes, with various energy-related zones within each environmental system. Each zone has a unique set of physical factors and sedimentological properties that will determine the potential fate of a dredged material deposit. Prediction of the fate of dredged material at a disposal site requires knowledge of: (1) currents, (2) waves, (3)tide, (4) suspended sediment concentrations, (5) seasonal energy fluctuations, (6) storms, (7) dredging/disposal operations, (8) shipping traffic, (9) fisheries activities, (10) bathymetry, (11) sedimentology, and (12) biological activity. (WES)
W80-03396

CONFINED DISPOSAL AREA EFFLUENT AND LEACHATE CONTROL (LABORATORY AND FIELD INVESTIGATIONS),
University of Southern California, Los Angeles. and Army Engineer Waterways Experiment Station, Vicksburg, MS.
K. Y. Chen, J. L. Mang, B. Eichenberger, and R. E. Hoeppel.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 882, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report DS-78-7, October 1978. 94 p, 5 Fig, 12 Tab, 9 Ref.

Descriptors: *Effluents, *Leachates, *Waste disposal, Groundwater, Water pollution control, Dredging, Chemical analysis, Influents, *Dredged material, *Containment areas.

Summarizes findings of five work units concerned with impact of dredged material disposal in confined land disposal areas. Three work units dealt with active disposal operations at 11 sites; impact was assessed by comparing the quality of influents and effluents at each site with background surface receiving water. Two work units evaluated impact of confined disposal area leachates on groundwaters. Leachate studies included laboratory column elutions (3- to 9-month period) of each of five types of dredged material overlying one of two different soils; four field sites were also monitored for changes in leachate and groundwater quality in a 9-month study. Field sites included fresh and brackish water dredging environments in geographical areas where contamination problems were anticipated. Dredged material and environmental features varied greatly at different sites. In most cases soluble concentrations of most chemical constituents were very low. Only soluble manganese and ammonia nitrogen levels failed to meet most criteria. Leachate studies suggest the disposal of brackish water dredged material in upland disposal areas may render subsurface water unsuitable for public water supply or irrigation purposes. Guidelines for evaluation of potential disposal sites should be developed in steps not requiring complete execution of total program to determine site suitability. (WES)
W80-03398

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BUTTERMILK SOUND MARSH DEVELOPMENT SITE, ATLANTIC INTRACOASTAL WATERWAY, GEORGIA: APPENDIX A: PROPAGATION OF MARSH PLANTS AND POST-PROPAGATION MONITORING,
Georgia Univ., Brunswick. Marine Extension Service.
R. J. Reimold, M. A. Hardisky, and P. C. Adams.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 867, Technical Report D-78-26, July 1978. 1498 p, 48 Fig, 59 Tab, 121 Ref, 9 Append.

Descriptors: Marsh plants, *Vegetation establishment, Waste disposal, Habitats, Dredging, Georgia, *Dredged material, *Habitat development, *Atlantic Intracoastal Waterway, *Buttermilk Sound(Georgia).

A field study to test the feasibility and impact of developing a marsh on dredged material was initiated in 1975 at Buttermilk Sound near the mouth of the Atlamaha River, Glynn County, Georgia. The 2-ha island is in the Atlantic Intracoastal Waterway and is an area of dredged material disposal for maintenance dredging of the waterway. This

report presents the results of habitat development activities between spring 1975 and fall 1977 and is Appendix A to the Buttermilk Sound marsh development site summary report. The site was graded to a 3.7 percent slope and partitioned into three elevation zones which were subjected to tidal inundation less than 6 hours each day, 6 to 18 hours each day, and more than 18 hours each day, respectively. Each zone was treated with a combination of experimental plantings including seven marsh plant species, two forms of propagule, and five patterns of fertilizer application. The plants were monitored for their response to fertilizer and inundation levels. Within the plots, interstitial water chemistry, soil chemistry, soil microbiology, and invading plant species were monitored. Aquatic biota and wildlife observations were made. (WES)
W80-03399

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, WINDMILL POINT MARSH DEVELOPMENT SITE, JAMES RIVER, VIRGINIA: APPENDIX F: ENVIRONMENTAL IMPACTS OF MARSH DEVELOPMENT WITH DREDGED MATERIAL: SEDIMENT AND WATER QUALITY,
Wright State Univ., Dayton, OH.; and Old Dominion Univ., Norfolk, VA.
D. D. Adams, D. A. Darby, and R. J. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 917, Price codes: A05 in paper copy, A01 in microfiche. US Army Engineer Waterways Experiment Station, Vicksburg, MS. Tech Rept D-77-23, Aug 78. Vol I: Characteristics of Channel Sediments Before Dredging and Effluent Quality During and Shortly After Marsh Habitat Development. 79 p, 6 Fig, 25 Tab, 70 Ref.

Descriptors: *Environmental effects, *Connate water, *Habitats, Sediments, *Dredging, Marshes, Water quality, Virginia, *Habitat development, Dredged material, Waste disposal sites, *Windmill Point(VA), James River(VA).

First of a two-volume appendix presenting the results of chemical and sedimentological studies conducted at a dredged material marsh development site located near Windmill Point, on the tidal freshwater James River, 16 km below Hopewell, Virginia. Navigation channel sediments were collected in January 1975, before dredging and marsh development, and described according to their temperature, pH, oxidation reduction potential, percent water, percent volatile solids, particle size composition, mineralogy, and cation exchange capacity. Sediment interstitial water and total sediment concentrations of sulfides and various nutrients and metals were also documented. The relationships between channel sediment characteristics and the chemical quality of effluent leaving the diked marsh development site were studied under three different conditions: (1) in January, 1975--during actual dredging and dredged material disposal for marsh substrate development, (2) during dewatering (2-4 days after the completion of dredged material disposal operations), and (3) in May 1975--3.5 months after dredging, before the marsh vegetation planting operations had begun or any extensive natural vegetation development had occurred. During dredging, about two-thirds of the channel sediments' organic material was lost, probably by flotation or as organic surface scums. Average concentration of suspended solids leaving the dike during dredging was 16 percent. (WES)
W80-03400

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, WINDMILL POINT MARSH DEVELOPMENT SITE, JAMES RIVER, VIRGINIA, APPENDIX E: ENVIRONMENTAL IMPACTS OF MARSH DEVELOPMENT WITH DREDGED MATERIAL: METALS AND CHLORINATED HYDROCARBON COMPOUNDS IN MARSH SOILS AND VASCULAR PLANT TISSUES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. D. Lunz.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 170, Price codes: A04 in paper copy, A01 in microfiche. Technical Report D-77-23, August 1978. 88 p, 18 Fig, 10 Tab, 38 Ref.

Descriptors: *Environmental effects, *Dredging, *Marshes, *Chlorinated hydrocarbon pesticides, *Metals, Dredged material, *Habitat development, Vascular plants, Virginia, *Windmill Point(VA), James River(VA).

Soil and vascular plant tissue samples were collected in October 1976 from three freshwater marshes located on the James River in Virginia. One marsh had been constructed using dredged material during 1974-75 maintenance dredging of the James River navigation channel. The other marshes were natural. The marshes studied had similar substrate characteristics. All were fine-textured silt and clay with volatile solids values between 10 and 20 percent, and contained about 50 percent water. Elevation and plant community characteristics were similar. Soil and plant tissue samples were analyzed for the metals nickel, zinc, chromium, lead, and cadmium and the chlorinated hydrocarbon compounds DDT, DDD, DDE, lindane, heptachlor, heptachlor epoxide, chlordane, endrine, dieldrin, Kelthane, Kepone, PCBs, and toxaphene. Marsh soil concentrations of chromium, cadmium, and lead were higher in the dredged material marsh; nickel and zinc concentrations were higher in the natural marsh. Low detectable levels of DDD, chlordane isomers, and Arochlor 1260 (PCB) occurred most frequently in dredged material marsh soils. Nickel was the only metal identified in experimental marsh plant tissue at higher levels than in similar tissue from a natural marsh. Potential soil chemical to plant transfer routes including surface sorption and adsorption and translocation were evidenced and discussed. (WES)
W80-03401

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BOLIVAR PENINSULA, MARSH AND UPLAND HABITAT DEVELOPMENT SITE, GALVESTON BAY, TEXAS; SUMMARY REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
H. H. Allen, E. J. Clairain, R. J. Diaz, A. W. Ford, and L. J. Hunt.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A066 224, Price codes: A07 in paper copy, A01 in microfiche. Technical Report D-78-15, August 1978. 73 p, 5 Tab, 36 Ref, 3 Append.

Descriptors: *Habitats, *Marshes, *Environmental effects, *Dredging, Vegetation, Vegetation establishment, Texas, *Dredged material, *Galveston Bay(TX).

A 2-1/2-year field investigation was conducted at Bolivar Peninsula, Galveston Bay, Texas, to test the feasibility and impact of developing marsh and upland habitats on dredged material. Baseline information derived before habitat development operations and results of postdevelopment operations are summarized. Two marsh grass species and nine upland plant species including trees, shrubs, and grasses were planted in test plots on a dredged material site lying between the Gulf Intracoastal Waterway and Galveston Bay. Tests were conducted to measure plant survival and performance in response to different fertilizer treatments and planting methods. Plantings of marsh grasses were made within an intertidal area protected from wave energies by sandbag dike. Prior to and during plant development, information was collected to document changes in fish and wildlife communities. Plantings were successful in both marsh and upland. Components of the habitat development site, consisting of planted vegetation and sandbag dike, attracted insects, aquatic organisms, and birds. After less than a year of development, the site provided heterogeneous habitats which tended to support greater use by fish and benthos than generally associated with sandy shores along Bolivar Peninsula. The study indicated habitat development is a feasible dredged material disposal alternative. (WES)
W80-03402

EPA'S HAZARDOUS-WASTE PROGRAM: WILL IT SAVE OUR GROUND WATER,
G. Dallaire.
Civil Engineering, Vol 48, No 12, p 39-45, December, 1978. 4 Fig.

Descriptors: *Hazards, *Waste disposal, *Ground water, Regulations, Water pollution control, Landfills, Lagoons, Aquifers.

Case histories of ground water contamination by hazardous wastes are presented as examples of what the EPA hopes to prevent by imposing strict regulations on generators, transporters, storers, processors, and disposers of hazardous wastes. Once an aquifer is polluted it tends to remain polluted. The EPA's strategy is to keep hazardous materials out of aquifers by keeping track of them and ensuring that the final disposal site is insulated from the ground water. Landfills, lagoons and injection wells are the only means of disposal in many areas due to previous regulations barring incineration and surface water disposal. Weaknesses in the new EPA regulations include: ambiguity in defining hazardous wastes, overdesigning of waste disposal facilities, high retrofitting costs of landfills and lagoons, continuing contamination from abandoned landfills and lagoons, and lack of assurance that waste generators will comply with the regulations. (Purdin-NWWA)
W80-03431

HYDROLOGIC DATA FROM A DEEP TEST WELL, CITY OF SARASOTA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5D.
W80-03482

TERMINAL ISLAND SEWAGE TREATMENT PLANT OUTFALL, LOS ANGELES HARBOR, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
W. H. McAnally, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 247, Price codes: A03 in paper copy, A01 in microfiche. Technical Report H-78-23, December 1978. 31 p, 2 Tab.

Descriptors: *Sewage treatment, *Outfall sewers, *Treatment facilities, *Hydraulic models, California, *Los Angeles Harbor(Calif), *Long Beach Harbor(Calif), *Terminal Island(Calif).

Proposed relocations of the Terminal Island Treatment Plant outfall in Los Angeles Harbor were tested in a physical hydraulic model of Los Angeles and Long Beach Harbors, California. The model reproduced proposed plans of harbor modifications that included dredging and landfill in Los Angeles Harbor and dredging and construction of an oil loading pier in Long Beach Harbor. Five potential locations of the outfall were tested for conditions of a mean tidal range, a modeled effluent representing a prototype effluent of 10 ppt and 76F discharging into receiving water of 34 ppt and 60F. Model effluent was dyed red and photographed as it moved through the harbors. Outfall locations along the face of the proposed Los Angeles phase I landfill produced a plume that generally followed an eastward curving path toward the breakwater, passing out through Angel's Gate with ebb phase flows. During flood phase flows some dye moved back northward toward the outfall location. One location, near the western edge of the proposed landfill, showed an instability in direction of plume travel, moving westward at times. Tests of two locations were performed with a possible phase II landfill installed in the model. (WES)
W80-03560

DISPOSAL OF DREDGED MATERIAL WITHIN THE NEW YORK DISTRICT: VOLUME I-PRESENT PRACTICES AND CANDIDATE ALTERNATIVES,
MITRE Corp., McLean, VA. METREK Div.

For primary bibliographic entry see Field 5B.
W80-03586

5F. Water Treatment and Quality Alteration

ALUMINA-LIME-SODA PILOT PLANT TESTING AT THE U.S. BUREAU OF RECLAMATION DESALTING TEST STATION AT YUMA, ARIZONA,
Midwest Research Inst. Kansas City, MO.
A. D. Tippit, and J. W. Nebgen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143688, Price codes: A05 in paper copy, A01 in microfiche. Final Report Prepared for Office of Water Research and Technology, 1979. 76 p, 10 Fig, 36 Tab, 3 Append, 14-34-0001-9509.

Descriptors: *Silica, *Desalination processes, *Aluminum, *Lime, *Water treatment, Arizona, Reverse osmosis, Waste water treatment, Brines, Saline water, Brackish water, Pilot plants, Colorado River, Irrigation water, Cost analysis, Alumina-lime-soda process.

As a part of research being done at the Bureau of Reclamation's Yuma desalting plant, alumina-lime-soda, a specific process for silica removal from saline water in the pH range 8.5 to 9.0, was tested at Yuma, Arizona, in a 10,000 GPD pilot plant. Two types of water were used for the testing, one was chlorinated degritted Wellton-Mohawk Canal water which is brackish water pumped from irrigation fields to prevent salt buildup and the other was waste brine generated by several small reverse osmosis units. A flow diagram for the alumina-lime-soda treatment process is given along with start-up and shut-down procedures. The process involves treating water with sodium aluminate to provide alumina for removal of soluble constituents in raw water. The lime is used to maintain pH conditions for the reactions taking place. Test runs were performed by operating the plant for several days at a predetermined pH condition. Influent and effluent samples were composited hourly and daily and were analyzed for calcium, magnesium, sodium, chloride, sulfate, alkalinity, and silica. Results show that silica in the canal water can be reduced from 40mg/liter to 10mg/liter and the brine can be reduced from 60 to 70mg/liter to 10mg/liter. Cost analyses show canal water treatment to be $0.48/1000 gal at a pH of 8.5 and brine treatment to be $0.43/1000 gal at a pH of 8.5. For reverse osmosis desalination the maximum silica reduction occurs at the same point as minimum chemical cost. (Seigler-IPA)
W80-03307

WATER PURIFIER SYSTEM AND VALVE,
T. V. Tyler.
U.S. Patent No 4,176,063, 17 p, 9 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1051, November 27, 1979.

Descriptors: *Patents, *Water purification, *Water treatment, Reverse osmosis, Membrane processes, Domestic water, Valves, Equipment, Water conservation.

An economical and commercially practical reverse-osmosis water purifier system has no back pressure acting against the semipermeable membrane, so that the filtering rate is maximized. Furthermore, the supply of tap water to the system is shut off automatically as soon as the pure water storage tank is full; use of water is greatly reduced. A single tube extends to the spigot from the pure water storage tank and contains a check valve which maintains pressure at the spigot when such storage tank is depressurized for maximized filtering speed. When the spigot is opened, the drop in water pressure in the tube opens a valve which passes squeeze water to the depressurized tank, whereupon it pressurizes to force pure water out the spigot. When the storage tank is full of pure water, a valve is closed automatically, thus preventing further flow of water to the drain so that water use is reduced. The opening of the spigot operates a pressure-responsive pilot valve which in turn opens a squeeze-control valve. These valves, and also the check valve, and the valve which shuts down water flow when the storage tank is full of pure water, are economical, sensitive and rugged diaphragm valves. (Sinha-OEIS)
W80-03310

THE PLACING OF THE DISINFECTION STAGE IN A RECLAMATION PLANT TO REDUCE HALOFORM FORMATION,
Water Research Commission, Pretoria (South Africa).
O. O. Hart.
Water SA, Vol 5, No 4, p 178-188, October 1979. Presented at Symposium on 'Disinfection of Water', Pretoria, November 16, 1978. 12 Fig, 2 Tab, 45 Ref.

Descriptors: *Chlorination, *Halogens, *Ozone, *Disinfection, *Water treatment, Chemical analysis, Gas chromatography, Adsorption, Bromides, Activated carbon, Public health, South Africa, Water sampling, Reclamation, Potable water.

Four chlorination process configurations were investigated at the Stander Water Reclamation Plant in Pretoria, South Africa, to identify the process that would produce the least concentration of volatile halogenated hydrocarbons (VHH). Chlorination of water supplies may produce halogenated compounds that could be carcinogenic. A flowchart is presented for the four process configurations. For each process tested 24 hour representative samples were collected after the 8th day of process operation. A Hewlett Packard 5710A gas chromatograph with an auto-sampler was used for quantative analyses. Results show that the configuration process producing the lowest VHH concentrations for this particular plant is breakpoint chlorination followed by two-stage active carbon adsorption. It was also shown that: activated carbon is effective in removing VHH if at least 30 minutes of contact time is allowed; the higher the bromide concentration in the water, the higher VHH yield; and the mole ratio of bromide to total organic carbon can indicate the ultimate VHH concentration to be expected. Various pros and cons of chlorine disinfection and ozone disinfection were also examined. (Seigler-IPA)
W80-03324

THE SIGNIFICANCE OF THE ROOT MEAN SQUARE VELOCITY GRADIENT AND ITS CALCULATION IN DEVICES FOR WATER TREATMENT,
Separa (PTY) LTD, Johannesburg, (South Africa).
P. Polasek.
Water S.A., Vol 5, No 4, p 196-207, October 1979. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Water treatment, *Hydrodynamics, *Mixing, *Hydraulic systems, *Fluid mechanics, Hydraulic models, Physics, Energy gradient, Velocity, Head loss, Flow around objects, Resistence, Kinetics.

Various types of hydraulic and mechanical agitators used in chemical water treatment processes are reviewed in terms of their root mean square velocity gradients. The rate of aggregation of destabilized particles in the water is dependent on the movement of the particles which is effected by the agitation of the water. The intensity of agitation in a system (rapid mixing, rapid agitation, or slow agitation) can be expressed by the instantaneous velocity gradient G in a flow. However, because the value of G varies throughout an agitation system and is difficult to calculate, the root mean square velocity gradient can be substituted. Types of hydraulic (gravitational) agitation systems reviewed are flash mixers, baffled mixers (perforated and slot), orifice mixers, and ring water jump mixers. Baffled channels and sludge blankets are agitation arrangements discussed for the hydraulic agitators. Mechanical agitators reviewed are flash mixers with three agitation arrangements, revolving agitators, and reciprocating agitators. Hydraulic or gravitational agitators are recommended for use only when the nominal flow design can be maintained at all times with no great variation in raw water quality or temperature. The Euler criterion of hydrodynamic similarity was found to be an accurate means of calculation of the useful power imput of mechanical agitation. (Seigler-IPA)
W80-03326

APPARATUS AND METHOD FOR TREATMENT OF FLUID WITH OZONE,
K. Stopka.
U.S. Patent No 4,176,061, 9 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1050, November 27, 1979.

Descriptors: *Patents, *Water purification, *Water treatment, Water pollution treatment, Aeration, Ozone, Bubbles, Domestic water, Potable water, Equipment.

The invention relates to a method of and an apparatus for purifying drinking water. The apparatus comprises of an ozonator for providing a gas containing ozone and an aspirator which mixes the gas with water to provide an ozone and water mixture having microbubbles of gas. The mixture is then circulated through an elongated treatment conduit having a length of between about 20 to 40 feet and a diameter less than 1 inch to allow the gaseous ozone to dissolve in the water. Throughout the length of the conduit the ozone oxidizes impurities in the water and provides water having a relatively high purity. The ozonator used to provide ozone is capable of providing a gas having at least 1.2 weight percent ozone, preferably a gas having an ozone concentrations approaching 2 weight percent. The ozonator is comprised of electrodes connected in series by gas flow lines. (Sinha-OEIS)
W80-03332

RESIN TREATMENT IMPROVES HIGH-COLOR GROUND WATER,
Fuhrberg Waterworks, Hannover (Germany, F.R.).
W. Kolle.
Water & Sewage Works, Vol 126, No 1, p 68-69, January, 1979. 5 Fig.

Descriptors: *Anion exchange, *Water treatment, *Humic acids, *Resins, Turbidity, Organic wastes, Filtration, Aerobic bacteria, Chlorination, Ground water.

The treatment of turbid ground water using strong basic anion exchange discussed. The water treated contained iron, manganese, humic acids, and sulfate. About 1,347,000 gallons can be filtered through 36 cubic feet of resin before the next regeneration becomes necessary. The resin is regenerated with a sodium chloride and sodium hydroxide solution which can be used several times. Removals of organics do not significantly increase with decreasing filter velocity. The resin significantly reduces bacterial growth in the drinking water and, correspondingly, chlorine consumption. (Purdin-NWWA)
W80-03436

PRODUCTION OF HALOFORM PRECURSORS BY WATER PIPE BACTERIAL FILMS.
Missouri Univ.-Rolla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W80-03478

5G. Water Quality Control

PERSPECTIVES FROM THREE YEARS EXPERIENCE OF REGIONAL WATER SERVICES IN THAMES WATER AUTHORITY,
Thames Water Authority, London (England).
P. Black, and A. Morrison.
Water Resources Bulletin, Vol 15, No 6, p 1578-1588, December 1979. 7 Ref.

Descriptors: *Water management(Applied), *Administration, *Watershed management, Water supply, Drainage, Rivers, Watersheds(Basins), Sewage, Sewage treatment, Sewage effluents, Sewage disposal, Pollutants, Water pollution, Water quality, Droughts, Regulation, Water re-

sources, *England, *Water authorities, *Thames River(England).

Thames Water is one of ten Regional Water Authorities established in 1974 to manage all water services in England and Wales. This paper looked back at water reorganization and reviewed the achievements and highlights of the past three years. Constitutionally, Water Authorities are a combination of a nationalized industry and local authority. This has advantages and disadvantages. Freedom of action, particularly in financial matters, is constrained by government and official agencies. A severe pollution of the upper Thames and the drought of 1976 tested Thames Water's ability to deal with emergencies. Thames Water does not have an operational monopoly. Private water companies supply one third of the water demand, and local authorities manage nearly all the sewers. But Thames Water's control over planning and investment ensures that the river basin is managed in a coordinated fashion. Tariff structure changes have led the Authority to bill all its consumers direct. The Thames is a small but intensively used river, and vigilance is needed to maintain water quality. Thames Water is proud of the restoration of the tidal Thames from a typical grossly polluted metropolitan estuary to its present excellent condition. The British government intends to establish a national water industry strategic planning organization, but at the same time they affirm that there can be no departure from the principle of integrated river basin management. (Sims-ISWS)
W80-03364

CONFINED DISPOSAL AREA EFFLUENT AND LEACHATE CONTROL (LABORATORY AND FIELD INVESTIGATIONS),
University of Southern California, Los Angeles. and Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5E.
W80-03398

WATER QUALITY COMMITTEE (ANNUAL REPORT).
American Bar Association, Washington, DC.
Natural Resources Lawyer, Vol 12, No 1, p 273-310, 1979.

Descriptors: *Water quality, *Effluents, *Water quality standards, Legislation, Oil spills, Administrative decisions, Judicial decisions, Toxins, Pollution, Water quality control.

In 1978, developments in the water quality field caused a shift in the focus of Clean Water Act (CWA) litigation. From the effluent guidelines, the controversy shifted to questions involving deadline extensions, effluent standards for toxic pollutants, and enforcement of the National Pollutant Discharge Elinination System (NPDES). A district court decision invalidated federal Environmental Protection Agency (EPA) regulations governing hazardous substances. Hasty legislation was implemented in an attempt to revive the EPA's program governing hazardous substances. The EPA published effluent guidelines and standards of performance for additional industrial categories. EPA programs to establish 'best available technology' effluent limitations for toxic pollutants were continued throughout the year. The EPA also began to implement the 1977 amendments of the CWA. Also adopted or proposed were comprehensive amendments to its regulations governing grants, water quality planning and management, and the NPDES program. These actions and other highlights of the 1978 CWA developments are explored. Legislative activity, judicial decisions, and administrative actions are reviewed in detail. (Quarles-Florida)
W80-03405

ANTI-CORROSION COMPOSITION FOR USE IN AQUEOUS SYSTEMS,
Quatic Chemicals Ltd., Guelph (Ontario). (Assignee).
F. Suzuki.
U.S. Patent No 4,176,059, 7 p, 2 Tab, 10 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1049-1050, November 27, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Industrial water, Scaling, Corrosion, Cooling water, Chemical reactions, Heat exchangers, Recirculating water.

A low toxicity, corrosion and scale inhibiting composition for use in recirculating aqueous systems, e.g. in heat exchangers, comprises from about 3-1,000 parts by weight of molybdate, from about 0.5-1,000 parts by weight of an organic cationic or non-ionic surfactant, from about 0.3-1,000 parts by weight of a water soluble polyphosphate and from about 0.05-500 parts by weight of an azole, for example tolyltriazole. The composition is water soluble or water dispersible, and is effective in very small amounts (3-3,500 ppm) for corrosion control of metals such as carbon steel, copper and aluminum exposed to circulating water. (Sinha-OEIS)
W80-03409

METHOD MEANS FOR DE-SILTING WATER,
J. J. Grobler.
U.S. Patent No 4,176,058, 10 p, 8 Fig, 2 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 988, No 4, p 1049, November 27, 1979.

Descriptors: *Patents, *Water purification, *Water treatment, *Reservoir silting, Suspended solids, Silts, Sediment control, Floating, Bubbles, Aeration, Agglomeration, Silt recovery.

The invention relates to a method and a means for desilting water. The settling of silt in inland lakes and dams considerably reduce the effective life span of such lakes and dams, and also cause a substantial loss of fertility of the agricultural lands from which the silt originates. The invention provides a method for removing silt particles from water by first agglomerating the silt particles into larger size particles, imparting hydrophobic properties to the larger size particles and floating them to the surface, and removing the floated matter. The invention also provides an apparatus for removing silt particles from water which includes means for feeding into and mixing with the water chemicals selected for agglomerating the silt particles and converting them into larger size hydrophobic particles, means for bubbling air through the water to float the larger size particles to the surface, and means for removing the floated matter. (Sinha-OEIS)
W80-03410

EXECUTIVE SUMMARY OF THE REPORT 'SURFACE IMPOUNDMENTS AND THE EFFECTS OF GROUND WATER QUALITY IN THE UNITED STATES--A PRELIMINARY SURVEY'.
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 5B.
W80-03424

EPA'S HAZARDOUS-WASTE PROGRAM: WILL IT SAVE OUR GROUND WATER,
For primary bibliographic entry see Field 5E.
W80-03431

USE OF ENVIRONMENTAL DATA IN ASSESSING THE QUALITY OF IRRIGATION WATER,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
A. Cass.
Soil Science, Vol 129, No 1, p 45-53, January 1980. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Irrigation water, *Water quality, *Data collections, *Model studies, *Africa, Rivers, Irrigation practices, Management, Salinity, Sampling, Rainfall, Evapotranspiration, Soil water, Drainage, Soils, Salt tolerance, *Natal(South Africa), Sodium adsorption ratio, Environmental model.

The quality of irrigation water of selected rivers in Natal is characterized in terms of chemical components related to salinity and sodicity. Using rainfall and evapotranspiration data for each sampling site, and assuming certain management practices, the authors calculated the anticipated soil water salinity and sodicity values for poorly drained soils, obtaining four variables to assess water quality: water salinity and sodicity and soil salinity and sodicity. Grouping the data according to crop salt tolerance and soil sodicity limitations confirms the evaluation of water quality obtained using recently published schemes for assessing irrigation water. The general agreement between schemes for classifying irrigation water indicates the feasibility of using a system of evaluation of water quality based on crop, soil, and climatic characteristics of the area under consideration. Comparing the saturation extract salinity and sodicity of poorly drained soils with salinity and sodicity calculated from this environmental model showed reasonably good agreement, which did not invalidate the general qualitative usefulness of this approach. (Visocky-ISWS)
W80-03471

PROXIMITY OF AGRICULTURAL AREAS TO MAJOR AQUIFERS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03480

CENTRIFUGAL WATER OIL SEPARATOR,
Continental Oil Co., Ponca City, OK. (Assignee).
J. K. Sammons, and C. H. Fox, Jr.
U.S. Patent No 4,175,040, 6 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 988, No 3, p 699-700, November 20, 1979.

Descriptors: *Patents, *Water pollution control, Water quality control, Separation techniques, Oil pollution, Centrifugation, Equipment, Oil recovery.

A simple, efficient apparatus for reducing the oil content of water recovered from production means and withdrawn from contaminated areas to levels environmentally acceptable is described. A centrifugal oil-water separator comprises an inner spinning bowl having openings near the lower outer periphery for passage of water into an outer bowl which remains stationary. The oil-water mixture is passed to the upper center of the spinning bowl where the oil and water separate. The oil concentrates near the top of the inner bowl. Disposable water is removed from the outer bowl and the oil is recovered from a trough adjacent the top of the spinning inner bowl. (Sinha-OEIS)
W80-03522

WASHER/SEPARATOR SYSTEM FOR DRILLING CUTTINGS IN WATER ENVIRONMENT OIL WELLS,
J. D. Fisher.
U.S. Patent No 4,175,039, 8 p, 4 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 988, No 3, p 699, November 20, 1979.

Descriptors: *Patents, *Water pollution control, *Water quality control, *Oil pollution, Separation techniques, Drilling, Drilling fluids, Equipment, Offshore oil wells, Well cuttings.

A method and apparatus for disposing of cuttings intermingled with fluids, such as oil, which are considered pollutants in water, from a well being drilled in a water environment offshore is described. A receiving tank with an agitation subchamber causes thorough scrubbing of the deposited drilling cuttings. The wash cuttings settle to the bottom of the tank causing the solution level to rise. When a predetermined solution level is reached, an auger, situated at the bottom of the tank, is activated and the collected cuttings are removed. When the solution level drops a sufficient amount for the removal of the cuttings, the auger is shut off and the cycle begins anew. Fresh water washing solution may be used, so that the oil saturated depleted solution may be added to the drilling mud. Collected cuttings may be deposited in the ocean without a slick forming. (Sinha-OEIS)
W80-03530

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME V-APPENDIX D, WATER SUPPLY AND WATER POLLUTION CONTROL.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 273, Price codes: A99 in paper copy, A01 in microfiche. Prepared by the Federal Water Pollution Control Administration for the Ohio River Basin Coordinating Committee, June 1967. 804 p, 25 Fig, 293 Tab, 13 Append.

Descriptors: *Water resources development, *Ohio River Basin, Water supply, *Water pollution, *Water quality, *Economic prediction, *Population, *Multiple purpose projects, *Water quality control, Planning, Industry, Water demand, Acid mine wastes, Waste load, Pollutants, Stream pollution.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly for that portion within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix presents water supply and water pollution control data both for the region as a whole and for each of 13 subbasin areas. The objectives are to determine overall requirements for municipal and industrial water supply and water quality control and to give general appraisals of measures required to meet the indicated needs. The report includes a description of the Basin, its economy, requirements for municipal and industrial water supply, and water quality control needs and problems. The methodological framework consisted of two distinct parts: an input-output econometric model to generate projections for population and economic activity, and an allocation procedure to distribute shares of the Basin projection to the subareas of the Basin. Projected increases in municipal and industrial water supply vary greatly among subbasins. Major water quality control problems include projected waste load increase, acid mine drainage, and heat pollution. Thirteen specific recommendations are made, including secondary treatment for municipal and industrial wastes, designing new sewerage facilities to prevent the necessity of by-passing untreated wastes, storage for streamflow regulation to enable increasing streamflow and waste assimilation during low flow periods, detailed investigations of costs of alternative treatment methods, a program for correcting acid mine drainage, and off-stream cooling methods. Detailed reports are included for the 13 sub-basin areas. (Arnold-NC)
W80-03577

LIQUID TREATMENT APPARATUS,
Ecodyne Corp., Lincolnshire, IL. (Assignee).
D. J. Butterworth.
U.S. Patent No 4,174,282, 7 p, 5 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 988, No 2, p 436, November 13, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Filtration, Industrial water, Nuclear powerplants, Filters, Ultra-filtration.

Liquid filters that produce the ultra pure water required from steam generation of electricity are commonly precoated with diatomaceous earth or powdered ion exchange resins. Such filters may have five hundred or more individual filter elements that are each over six feet in length. Full utilization of the liquid treating capacity of the precoat materials requires that the precoat be uniformly applied over the full length of each filter element. When the steam used for electric power generation comes from a nuclear reactor, the filtering apparatus becomes highly radioactive, and the individual filter elements must be capable of being installed and removed from a remote location. During prolonged usage, the dimensions of the individual filter elements may change, as for example when a wound nylon filter elements shrinks during high temperature service. Accordingly, it is an object of this invention to provide an improved liquid treatment apparatus that will fulfill the above requirements. (Sinha-OEIS)
W80-03585

FLOATING-TYPE ANTI-OIL, ANTI-IMPACT AND ANTI-WAVE BARRIER,
Mitsubishi Jukogyo Kabushiki Kaisha, Tokyo (Japan). (Assignee).
N. Toki.
U.S. Patent No 4,174,185, 7 p, 11 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 988, No 2, p 403, November 13, 1979.

Descriptors: *Patents, *Barriers, *Oil pollution, *Pollution abatement, Water quality control, Waves(Water), Floating, Check structures, Protection, Marine structures.

A floating-type anti-oil, anti-impact and anti-wave barrier includes means for intercepting a flow of oil floating on the water and diverting the oil in directions at right angles to the original direction of flow, means for mitigating an impact force exerted by a ship or the like, and means for intercepting waves. The barrier comprises a first float formed by serially arranging at regular intervals elongated boxes in their longitudinal direction. A second float is formed exactly in the same manner as the first float and placed parallel to the first float at staggered positions relative to each other. Floatable spaces having shock-absorbing and intercepting functions are placed between the side surfaces of the floating boxes. Chains or ropes moor the respective floating boxes to each other. The barrier can be utilized as a permanently installed anti-oil and anti-impact waterbreak for a marine oil storage tank, a marine plant, marine air-port, etc. (Sinha-OEIS)
W80-03593

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RESERVOIR STORAGE DETERMINATION BY COMPUTER SIMULATION OF FLOOD CONTROL AND CONSERVATION SYSTEMS,
Hydrologic Engineering Center, Davis, CA.
B. S. Eichert.
Technical Paper No 66, October 1979. 8 p, 8 Ref.

Descriptors: *Flood control, *Model studies, *Planning, *Computer models, Systems analysis, Reservoir operation, Reservoir storage, Water supply, Water storage, Multiple-purpose reservoirs, Hydroelectric power, Water conservation, HEC-5.

This paper presented ways that a comprehensive simulation computer program can be used in planning a water resources system composed primarily of multipurpose reservoirs with flood control as a major project purpose. The computer program HEC-5, Simulation of Flood Control and Conservation Systems, was used to illustrate the ways in which a generalized computer program can be applied to a wide variety of reservoir systems. The HEC-5 model can be used in almost any reservoir system regardless of location, project purposes, and physical conditions in the basin by specifying as input data such items as the configuration of the reservoirs in the basin, the project purposes, streamflow data, channel routing criteria, evaporation data, etc. (Humphreys-ISWS)
W80-03348

OPERATIONAL SIMULATION OF A RESERVOIR SYSTEM WITH PUMPED STORAGE,
Corps of Engineers, Savannah, GA.
G. F. McMahon, V. R. Bonner, and B. S. Eichert.
Hydrologic Engineering Center, Davis, California
Technical Paper No 60, February 1979. 30 p, 3 Fig, 6 Tab, 9 Ref, 2 Append.

Descriptors: *Reservoir operation, *Pumped storage, *River systems, *Systems analysis, *Georgia, Model studies, Multiple-purpose reservoirs, Reservoirs, Hydroelectric plants, Management, Computer models, Evaporation, Electric power, *Savannah River(GA).

This paper described an operational simulation used to evaluate the effects of the addition of pumped storage on hydropower production and recreation useability of a reservoir system. The operational simulation was in support of a study to determine the feasibility of installing pump-turbines at the Richard B. Russell Dam and Lake project, presently under construction and currently authorized for conventional hydropower, flood control, and recreation. The pumped-storage feasibility study addressed the recreational, environmental, hydropower, water supply, and economic impacts of pumped storage and conventional hydropower production at Russell on Corps of Engineer's dams on the Savannah River. The simulation results yielded evidence that system operation is more efficient than operation for at-site requirements, producing less dump energy, pumping energy, and primary energy shortages. In addition, system operation was simulated to reduce pool fluctuations and achieve a better balance of reservoir storage levels than operation with at-site requirements. It can be noted from data presented that the ratio of primary energy shortage to system demand with pumped storage is approximately 10% smaller than for system operation without pumped storage. This indicates that the addition of pumped storage could provide somewhat greater flexibility in meeting system requirements. (Humphreys-ISWS)
W80-03351

SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
B. S. Eichert, and D. W. Davis.
Technical Paper No 44, March 1976. 32 p, 1 Fig, 3 Tab, 4 Ref.

Descriptors: *Flood control, *Systems analysis, *Reservoirs, *Optimization, *Project planning, Model studies, Flood damage, River systems, Economics, Management, Planning, Hydrology, Annual benefits, Reservoir operation.

This paper discussed the scope of reservoir system formulation, modeling flood control systems, criteria and strategies for system formulation, and illustrated the concepts with applications in recent systems studies. The systems viewpoint applied to reservoir flood control systems includes the physical representation of the system (sites, storage, costs, stream conveyance, basin hydrology) and the economic representation of the consequences of flooding (damage centers, damage potential, frequency of flooding). The flood control system to be formulated consists of the reservoirs and their operating characteristics. Computer Program HEC-5C, 'Simulation of Flood Control and Conservation Systems,' has been developed by The Hydrologic Engineering Center as a generalized tool which can be used to simulate any flood control system. The program was written to be compatible with generally accepted analysis procedures that require data normally developed in the course of studying flood control reservoirs. (Humphreys-ISWS)
W80-03353

THE MANAGEMENT OF GROUND WATER SUPPLIES,
Ground Water Consultants Group, Edmonton (Alberta).
For primary bibliographic entry see Field 4B.
W80-03435

APPLICATION OF OPERATIONS RESEARCH TECHNIQUES FOR A PROBLEM IN WATER RESOURCES MANAGEMENT: ECONOMIC APPRAISAL OF CHANGES IN WATER USE INDUCED BY INVESTMENTS INTO NAVIGABLE RIVERS AND CANALS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Operations Research.
K. Hazeghi, W. Schmid, and P. Petalas.
In: Modeling, Identification and Control in Environmental Systems, p 977-988, North-Holland, Publishing Company, 1978. 3 Fig.

Descriptors: *Operations research, *Model studies, *Economic impact, *Water supply, *Navigable

rivers, Simulation analysis, Systems analysis, Cost-benefit analysis, Water allocation(Policy), Mathematical models, Economic efficiency, Water resources development, West Germany, Economic justification, Regional economics, Investment, Weirs, Canals, Engineering structures, Canals, Water utilization, Management.

A computer model was developed to determine net benefits accruing to urban, industrial and agricultural water users from construction of weirs and canals built for navigation purposes in West German river systems. The model, simulating a 1-yr period, analyzes costs of the most preferable alternative water supply and discharge (S/D) system. Economic effects are posited in physical terms accruing to water users by comparison of the channel-reservoir system under simulated conditions with and without the weirs and canals, as affecting supply of water, water quality and discharge capacity as well as utilization by water users for withdrawal and discharge purposes. Alternative costs in the model are those of the optimal water supply and discharge system needed under assumption of no construction of the canals and weirs, that will satisfy all user requirements if the construction were to take place. The model treats the S/D system in three interacting networks: an X network for water supply only, a Y network for water discharge only and a Z network performing both functions simultaneously, as well as that of water treatment plants. Criteria for benefits with alternate S/D systems are annual costs, the sum of yearly operation costs and the annuity of investment costs. Mathematica formulation of the problem, i.e., determination of the most economical alternate S/D system, leads to an optimization problem with partly linear and partly nonlinear constraints and nonlinear objective functions. (Harris-Wisconsin)
W80-03501

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME III-APPENDIX B, PROJECTIVE ECONOMIC STUDY.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 271, Price codes: A99 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee by Arthur D. Little, Inc., August 1964. 436 p, 7 Fig, 87 Tab, 12 Append.

Descriptors: *Water resources, *Water resources development, *Economic prediction, *Capital, *Planning, *Models, *Forecasting, *Ohio River Basin, *Employment, *Industrial production, Econometrics, Economics, Labor supply, Population, Methodology, Electric power, Regional development, Resources, Linear programming, Water policy.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin through water resource development. This Appendix presents the base economic data and projections for the area, the methodological framework used in the study, and a report on implementation of the projection model. The methodological framework consisted of an econometric forecasting model used to derive economic activity projections in the Basin as a whole, and an allocation procedure used to distribute projected output and employment estimates among the 19 subareas of the Basin. The purpose of the model was to project levels of industrial and government activity, income and employment to 1980 and 2010. The future labor supply was projected on the basis of population trends. Population projections were made using the component or cohort-survival method. The major procedures required to implement the projection model are outlined. The operational process was divided into three phases: (1) demographic projections of population and labor force; (2) derivation of base year values, projection parameters, and demand projections; and (3) reconciliation of results of the demographic projection with those of the demand projections. Detailed descriptions of the procedures are provided in the appendices. (Arnold-NC)
W80-03579

AN URBAN RUNOFF MODEL FOR TULSA, OKLAHOMA,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard, and S. Chang.
August 1978. 209 p, 6 Fig, 19 Tab, 63 Ref, 4 Append.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Model studies, *Streamflow, *Linear programming, *Models, *Mathematical modes, Tulsa(OK), Mingo Creek(OK), Haikey Creek(OK), Loss-rate functions, Drainage, Rational formula, Regression analysis, Hydrograph analysis, Unit hydrographs, Urbanization, Impervious surfaces.

The purpose of this study was to develop a method to adjust flood flows for effects of urbanization in the Tulsa (OK) area. As no Tulsa runoff data were available, data for similar areas were used in model development. Adjustment of flood flows to account for urbanization was accomplished by applying a rainfall-runoff model to representative storms and adjusting the parameters to reflect the various effects of urbanization. A literature survey was undertaken to assess available information on all existing hydrologic models. Twenty-five models were reviewed, of which only 7 were considered suitable for this application. The model finally chosen was the Flood Hydrograph Package of the Hydrologic Engineering Center (HEC-1). The package was used to derive model coefficients for each of the 114 floods studied. The general model was found to be highly flexible. Initial full-model and restricted-model calibrations were undertaken, and special calibrations were undertaken for treatment of impervious areas. The Clark unit-hydrograph parameter and loss parameter were separately related to drainage basin parameters by use of multiple linear regression. This procedure appears to produce excellent results in reproducing observed flood hydrographs from recorded rainfall. Applications of the model were made for Mingo and Haikey Creeks to compute runoff from the 1976 storm in the area. Data used in this study provide no evidence that urbanization appreciably affects runoff concentration times in the absence of channel improvements. About 40% of the impervious area appears effective in increasing volume of runoff. It is believed that the procedures used in the study are highly satisfactory for evaluating changes in runoff rates due to urbanization. (Arnold-NC)
W80-03582

AN APPROACH TO THE CONSTRUCTION OF THE REGIONAL WATER RESOURCE MODEL,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
M. Albegov, and V. Chernyatin.
Research Memorandum RM-78-59, November 1978. 38 p, 9 Fig, 8 Ref.

Descriptors: *Models, *Water resources, *Bulgaria, *Mathematical models, *Regional analysis, *Modeling systems, *Water quality, *Water management(Applied), *Regional development, Water resources planning, Model studies, Danube River, Analytical techniques, Water demand, Water supply, Water quality, Reservoirs, Irrigation, Water costs, Economics, Unit costs, Annual costs, *Silistra region(Bulgaria).

The authors attempt to define a special regional water resource model as part of a more general system of regional models. This model system embraces a multi-stage solution approach to regional problems, examining settlements and pollution; labor and capital; and the location of industry, agriculture, and public services as factors in the determination of water supply needs. The principal system approach simultaneously analyzes water supply costs of all subregions of a selected study area, using data such as average water cost per cubic meter, maximum water available for consumption, and the total expenses for the water supply. The primary goal for this kind of modeling--regional development (RD) modeling--is to determine the location and development level for regional production units for the area's economy. The mathematical model measures water supply, comparing the feasibility of meeting different water demands at various supply schedules; and water quality management parameters which are examined in light of water withdrawal levels in a given number of regional subregions, or districts, resulting in or having various pollution concentration levels. The first version of the water supply model was applied to Silistra, Bulgaria. Findings indicate that water unit costs are much higher during intensive irrigation periods, these costs increase when the irrigated land is moved farther from the river water source (Danube River), and water costs increase strongly in areas lacking reservoirs. (Arnold-NC)
W80-03587

THE DEVELOPMENT AND SERVICING OF SPATIAL DATA MANAGEMENT TECHNIQUES IN THE CORPS OF ENGINEERS,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
R. P. Webb, and D. W. Davis.
Technical Paper No 55, July 1978. 24 p, 7 Tab, 13 Ref.

Descriptors: *Model studies, *Analytical techniques, *Flood control, *Flood plain management, *Spatial data management, *Flood damage, Computer models, Computer techniques, Flood hazard, Flood data, Water resources planning, Planning, Environmental effects, Flood plains.

This study presents a system for managing hydrologic data and performing a comprehensive analysis of the impacts of existing and alternative future land use development patterns for floodplains. Spatial data management and processing techniques are employed using the group of software contained under DATA BANK PROCESSING INTERFACE. Various alternatives are evaluated for flood hazards for a specific storm event such as the 100-year flood, or for a range of storm events; monetary damages for a specific flood event and the expected value of annual damages are evaluated for 8 different alternatives; and alternative environmental impacts are evaluated. A series of Expanded Flood Plain Information Studies (XFPI) was undertaken using the techniques developed by the Corps. The original study was in the Oconee River Basin and has been completed; several others are near completion. Results of the Trail Creek watershed study are presented. The watershed occupies 12 miles of the Oconee pilot study area of 300 miles, and includes portions of Athens (GA). The area is 10% urban and expected to grow to 20-30% by 1990. The data bank developed for Trail Creek included 15 data variables. Flood hazard analysis presents results of evaluating existing and 1990 alternative conditions. Annual damage assessments for a range of hydrologic conditions and land use control policy sets are presented. Nonstructural flood plain evaluations using spatial data management techniques are presented. Environmental assessments include current and 1990 Trail Creek pollutants. Recommendations applicable to tasks such as spatial data management include the need to provide the computer software with a permanent home, using business-like computer code generation, and careful selection of studies. (Arnold-NC)
W80-03588

FLOOD DAMAGE ASSESSMENTS USING SPATIAL DATA MANAGEMENT TECHNIQUES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
D. W. Davis, and R. P. Webb.
Technical Paper No 57, November 1978. 25 p, 4 Fig, 2 Tab, 5 Ref.

Descriptors: *Analytical techniques, *Flood damage, *Flood control, *Frequency analysis, *Flood plain management, *Spatial data management, Flood plains, Non-structural alternatives,

Computer techniques, Flood data, Water resources planning, Flood stage, Structures, Geography, Management, Land use, Hydrology.

This study discusses the basic concepts of a spatial data management approach to flood damage appraisals and highlights its integrated use with more traditional individual structure approaches. Two major types of appraisals are the 'event' analysis, involving the development of a damage potential function and hydrologic data for the flood event of interest; and the expected annual damage analysis which employs the methods of the first analysis plus adding data for representing a flow-exceedance frequency function. Development of flood damage potential functions is achieved by stratifying the particular flood plain by damage potential, sampling stratified categories, then projecting damage potential for the entire study area. For accomplishing these tasks, use of the grid cell data bank is employed, with coding of various cells for type of existing land use, damage reach, and particular reference flood. Summary damage evaluations will then be possible, each comparing the existing damage reaches with the type of land use policy existing for that area. An integrated spatial and inventory approach was designed to make these programs more useable by the public and local/state agencies. The applications made to date confirm the soundness of the approach and indicate that the methods should aide in continuing the important movement toward a geographic approach to flood plain management. (Arnold-NC)
W80-03589

SPATIAL DATA ANALYSIS OF NONSTRUCTURAL MEASURES,
Hydrologic Engineering Center, Davis, CA. Planning Analysis Branch.
R. P. Webb, and M. W. Burnham.
Technical Paper No 46, August 1976. 19 p, 8 Fig, 4 Tab, 2 Ref.

Descriptors: *Model studies, *Analytical techniques, *Flood control, *Nonstructural alternatives, *Flood protection, *Flood plain management, *Flood damage, Flood plains, Planning, Flood proofing, Spatial analysis, Computer models, Structural damage, Flood data, Water resources development.

This article explains how evaluations of nonstructural flood loss reduction measures for existing and alternative future land use patterns can be made. A spatial data analysis model is advanced which employs the processing of spatial geographic data into a grid cell data bank which may then be accessed and manipulated in a computer bank. Inputs into the program include a description of flood damage reach boundaries; reference flood profiles; composite damage functions; and aggregate damage function data (e.g., value of the structure, density of development in the immediate area, stage vs. % damage for structure). Two major steps are involved in damage function development: (1) development of elevation-damage function at each cell, and (2) aggregation of cells to index locations by determining damage reach, index location, cell reference, then aggregating inputs for all cells. This method should make possible rapid evaluation of flood damage potential for existing and alternative future land use conditions and determination of potential flood damage resulting from various nonstructural measures. (Arnold-NC)
W80-03590

6B. Evaluation Process

A DYNAMIC REGIONAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES ON A WATER AND RELATED LAND RESOURCE PROJECT -- THE BOISE PROJECT OF IDAHO. PART I: DIRECT ECONOMIC IMPACTS, ECONOMICS SUBPROJECT,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. Long, T. Nelson, and G. Hines.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144280, Idaho Water Resources Research Institute, University of Idaho Research Technical Completion Report, March 1979. Volume I of V. 111 p, 7 Fig, 28 Tab, 26 Ref, 5 Append, OWRT C-6276(5226)(2).

Descriptors: *Idaho, *Cost-benefit ratio, *Economic impact, *Irrigation systems, Cereal crops, Field crops, Vegetable crops, Forages, Reservoir storage, Hydroelectric power, Flood control, Crop production, Agriculture, Irrigation programs, Boise Project.

Direct cost and return information is presented for the Boise Project, originally an irrigation and power project in southwestern Idaho. The Project was built by the Bureau of Reclamation from 1910 to 1956 and is now managed for irrigation, power, recreation, and flood control. Irrigated acreage in the area has increased from 51,377 acres to the current 390,000 acres with irrigation water from the Boise and Payette Rivers now stored in five reservoirs. Pre-project crops were primarily hay, grain, and pasture crops with a few seed crops, fruits, and vegetables. From 1910 to 1940 there was little change in crop patterns with forage and cereal crops continuing to dominate percentages while overall regional output increased. From 1940 to 1973 crop patterns changed with the technologic and economic boom following World War II. Forage and cereal crops percentages dropped while seed, fruit, vegetable, and field crop percentages increased. Benefit-cost ratios (value added per dollar of project cost) are given for each year from 1910 to 1973. The lowest ratio occurred in 1932 at a negative $0.59 and the highest ratio occurred in 1947 with $21.29. The project was only marginally economically successful prior to 1940, however, after that date a rapid upswing occurred. For every dollar spent on the project after 1940 about $5 in income resulted with the ratio for 1973 being $9.94. (Seigler-IPA)
W80-03309

A DYNAMIC REGIONAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES OF A WATER AND RELATED LAND RESOURCE PROJECT -- THE BOISE PROJECT OF IDAHO, PART III: ECONOMIC SCENARIO OF THE BOISE REGION 'WITHOUT' A FEDERAL IRRIGATION PROJECT, ECONOMICS SUBPROJECT,
Idaho Univ., Moscow.
T. L. Nelson, C. C. Warnick, and C. J. Potratz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144298, Idaho Water Resources Research Institute, University of Idaho. Research Technical Completion Report, March 1979, Vol III of V, 61 p, 4 Fig, 16 Tab, 17 Ref, OWRT C-6276 (5226) (4).

Descriptors: *Economic justification, *Economic prediction, *Comparative benefits, *Idaho, *Model studies, Irrigation systems, Cost-benefit ratio, Econometrics, Monetary benefits, Federal project policy, Projects, Estimated benefits, Project benefits, Project planning, Boise Project.

Two models were used to estimate the economic conditions in Idaho and the Boise region if the federally funded Boise Irrigation Project had never been built. A hydrologic model of the natural unregulated flows of the Boise and Payette Rivers was used to estimate the gross crop output that would have occurred without the Boise Project. Based on data from the hydrologic model an interregional trade flow model was also developed. Most of the precipitation for the two watersheds occurs as snow resulting in a heavy spring runoff. Flows then decline as summer progresses with August flows often being only 15% of June flows. Without the storage water provided by the Boise Project there would be little water for irrigation during the critical summer season. From the hydrologic model, average annual irrigation diversions available from both rivers without the Project was 705,000 acre feet. This diversion would have irrigated approximately 261,000 acres which in turn would produce $8,600,000 in crops by 1973. A comparison of these 'without' results to actual 'with' data shows that in 1972 while the 'without' acreage represents 77% of the actual 'with' acreage, the 'without' diversion is only 36% of the 'with' diversion. Further, the 'without' income represents only 18% of the 'with' diversion. Trade flow model results show that area output 'without' the Project would have been $1.6 billion compared to $1.8 billion 'with' the project as of 1970. The pattern for income is similar. The relative success of the Project is justified on the basis of economic efficiency. (Seigler-IPA)
W80-03311

A DYNAMIC REGIONAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES OF A WATER AND RELATED LAND RESOURCE PROJECT -- THE BOISE PROJECT OF IDAHO, PART IV: A SOCIAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES ON A WATER RELATED RESOURCE PROJECT: BOISE PROJECT, SOCIAL SUBPROJECT,
Idaho Univ., Kimberly. Water Resources Research Inst.
J. E. Carlson, and M. J. Sargent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144306, Research Technical Completion Report, March 1979. Vol IV of V, 134 p, 34 Fig, 6 Tab, 32 Ref, 1 Append. OWRT C-6276 (5226)(5).

Descriptors: *Idaho, *Social impact, *Project benefits, *Comparative benefits, Irrigation systems, Social change, Social aspects, Community development, Human population, Public health, Recreation, Education, Law enforcement, Boise Project.

Social changes resulting from the Boise Project, an irrigation and power project in southwestern Idaho are analyzed. The Project was built by the Bureau of Reclamation between 1910 and 1956 and is now managed for irrigation, power, recreation, and flood control. Both spatial and temporal impacts on Ada and Canyon Counties and changes from 1940 through 1970 are analyzed. A comparison is made of the quality of life 'with' the Project and 'without' the Project. Quality of life indicators used include education, housing and neighborhood, formal achievement, health (mental and physical), law enforcement, accessibility, and recreation. The most significant social impact has been on population numbers with the Project adding 38,000 to 22,000 residents from 1940 to 1970. Farm population has declined but not as sharply as it would have without the Project. The Project has apparently had little impact on education. Income has somewhat increased with fewer families classified as poverty level, however, the percent employed is little changed. Housing has been unaffected except for a quality improvement in 1940. Health has also been unaffected. Violent crimes and accessibility were slightly increased by the Project. Water-based recreation was greatly increased by the Project. Overall the apparent social impacts of the Boise Project have not been major. (Seigler-IPA)
W80-03312

A DYNAMIC REGIONAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES ON A WATER AND RELATED LAND RESOURCE PROJECT -- THE BOISE PROJECT OF IDAHO, PART V: ENVIRONMENTAL IMPACTS,
Idaho Univ., Moscow. Dept. of Geography.
J. E. Hultquist.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144314, Research Technical Completion Report, March 1979. Vol V of V, 114 p, 16 Fig, 20 Tab, 102 Ref. Idaho Water Resources Research Institute, University of Idaho. OWRT C-6276 (5226)(6).

Descriptors: *Idaho, *Environmental effects, *Irrigation, Habitats, Ecology, Productivity, Project benefits, Comparative benefits, Projects, Irrigation systems, Watersheds(Basins), Reservoir storage, Reservoir silting, Erosion, Water supply, Boise Project.

'Without Project' scenarios are compared to actual existing conditions to assess the environmental impact of the Boise Project, an irrigation and power project in southwestern Idaho. The Project was built by the Bureau of Reclamation between 1910 and 1956 and is now managed for irrigation, power, recreation, and flood control. One 'with'

scenario examined is the natural flow scenario. Without any storage only the diversion of natural flows could have been used for irrigation. Most of the area's precipitation is in the form of snow producing a heavy runoff and high flows in spring and low flows in summer. The low flows of July and August would have determined the maximum amount of land to be irrigated for the entire season. Estimated average annual irrigated acreage from natural flow is 152,500 acres. A second 'without' scenario, the storage scenario assumes the construction of only a 200,000 acre-foot reservoir. This storage capacity would provide an additional 48,800 irrigated acres. It is difficult to attribute many environmental changes directly to the Boise Project as it is evident that a great many changes were underway prior to the Project. Environmental changes are discussed along with various environmental evaluation methodologies. (Seigler-IPA)
W80-03313

ARCHEOLOGICAL INVESTIGATIONS ALONG THE SALT-GILA AQUEDUCT,
Museum of Northern Arizona, Flagstaff.
P. H. Stein.
Technical Report No DI-BR-APO-CCRS 79-3, November 1979. Prepared for the U.S. Bureau of Reclamation, Arizona Projects Office, 181 p, 17 Fig, 15 Tab, 112 Ref, 5 Append.

Descriptors: *Arizona, *Archaeology, *History, *Dating, *Surveys, *Arid lands, Southwestern U.S., Irrigation practices, Agronomy, Agriculture, Water storage, Droughts, Hohokam culture, Salt-Gila Aqueduct, Central Arizona Project.

Seventy archeological and/or historical sites were recorded during an intensive archeological survey of the area involved in the construction of the proposed Salt-Gila Aqueduct (SGA), a component of the Central Arizona Project designed to supplement the water supply of central and southern Arizona. The SGA project area, located in the Southern Basin and Range physiographic province, is characterized by through-flowing drainage systems with no natural lakes. With an average annual rainfall of less than 10 inches and a high evapotranspiration rate, the Gila River was the main perennial source of water in aboriginal times. A site file search was conducted to gather data on all sites previously recorded. This search identified 51 sites. Although the presence of man in the American Southwest is documented from at least 11,000 B.C., the distribution of sites from the survey indicated that the most valuable period of archeological study was the Hohokam period (300 B.C. to 1450 A.D.). The Hohokam were a sedentary people practicing both canal irrigation and floodwater farming. They excelled in the production of stone, shell, and clay crafts. A testable model of riverine and nonriverine Hohokam settlement/subsistence was developed. Also, different levels of sampling intensity were compared for locating nonsite remains. Excavation of various sites should provide more conclusive data. (Seigler-IPA)
W80-03321

AN ANALYSIS OF WATER RESOURCES CONSTRAINTS ON POWER PLANT SITING IN THE MID-ATLANTIC STATES,
National Center for the Analysis of Energy Systems, Upton, NY.
For primary bibliographic entry see Field 6D.
W80-03361

GEOTHERMAL WELL DRILLING ESTIMATES BASED ON PAST WELL COSTS,
Department of Energy, Idaho Falls, ID. Idaho Operations Office.
R. N. Chappell, S. J. Prestwich, L. G. Miller, and H. P. Ross.
Geothermal Resources Council, Transactions, Vol 3, p 99-102, September, 1979. 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Geothermal studies, *Drilling, *Estimated costs, Deep wells, Inflation, Planning, Regression analysis.

Nineteen geothermal wells of varying depths between 1500 and 10,000 feet and similar diameter were used in a statistical analysis of well construction costs. The general trend when the data points are plotted is exponential with depth. However, costs at any given depth can vary appreciably due to drilling conditions and unexpected problems. The straight line fit should not be extrapolated to obtain costs for geothermal wells less than 1500 feet deep. All the cost data were corrected for inflation. Since 1974, well drilling costs have almost doubled. (Purdin-NWWA)
W80-03427

THE ECONOMIC FEASIBILITY OF DUAL PURPOSE NUCLEAR DESALINATION OF GROUND WATER,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3A.
W80-03544

DAMS AROUND THE HOLY CITY OF MEDINA, AND THE PRESSURE ON ITS WATER SUPPLY,
Durham Univ. (England). Dept. of Geography.
M. S. Makki.
Journal of Arid Environments, Vol 2, No 4, p 363-367, Dec 1979. 1 Fig, 12 Ref.

Descriptors: *Urbanization, *Paleohydrology, *Dams, *Water demand, Environmental effects, Quaternary period, Tertiary period, Infiltration, Water supply, *Saudi Arabia, *Medina.

Recent intensive use of machine pumps, drier weather, increasing urbanization, and improvements in health care around Medina, a holy city of more than 100,000 which receives about a million pilgrims yearly, have created a growing problem of providing water for domestic and agricultural use. Medina's water now comes from a huge water storage trap formed from Tertiary and Quaternary basalt outpourings south of the city. It covers the ancient alluvium into which rainwater would otherwise infiltrate and protects groundwater from evaporation. The resultant limitation on infiltration along with the increasing extraction of groundwater have created imbalances in which demands far exceed precipitation. Several dams built in the area to increase the recharge by rainwater to the aquifer, are described in terms of their varying effects on valley floods and their implications in meeting water demands. It is concluded that the recent flexibility of official policy toward urban expansion, together with lack of water, have badly affected the natural environment around Medina. (Tickes-Arizona)
W80-03549

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIV-APPENDIX M, FLOOD CONTROL.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 2E.
W80-03569

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIII-APPENDIX L, NAVIGATION.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 280, Price codes: A06 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee, April 1968. 113 p, 25 Fig, 15 Tab, 1 Append.

Descriptors: *Water resources development, *Multiple purpose projects, *Ohio River Basin, *Resources development, *Navigation, *Comprehensive planning, *Projections, *Navigable rivers, Transportation, Water use, Canals, Commerce, Waterways, Water demand, Natural resources, Water policy, Regional development, Navigable waters.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee and Illinois. The main purposes are to determine the need for further flood control measures and to enhance the economic well being of the Basin. This Appendix delineates problems and development needs of the Basin's navigation system and presents a methodology for projecting annual gross demands on that system. By 2020, annual tonnage and ton-miles moved on the Ohio River are projected to increase more than 5 times the 1965 traffic; on tributaries in the study area, projected growth would be more than threefold. Additional demand for water-borne freight exists in areas of the Basin where there is presently no service but where potential waterways should be feasible before 2010. If these system extensions are constructed as needed, 6 billion ton-miles are projected to move on 320 new waterways by 2020. Structural measures are recommended to meet increasing demands, including deeper navigation channels and a lock-and-dam modernization program. In addition, technological and managerial measures will be necessary to meet projected needs. Total initial construction costs of the navigation development plan to 2020 is estimated at $1.8 billion, exluding projects in the 1965 program. Specific navigation problems and potential solutions for these problems are presented for each of the rivers in the Ohio River Basin. A comprehensive development program is also presented for navigation, including existing and projected new waterways. (Arnold-NC)
W80-03570

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XII-APPENDIX K, DEVELOPMENT PROGRAM FORMULATION.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 279, Price codes: A14 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee, July 1968. 317 p, 22 Fig, 28 Tab, 4 Attachments.

Descriptors: *Water resources development, *Water resources planning, *Water demand, *Ohio River Basin, *Administration, *Multiple purpose projects, *Regional development, *Water supply development, Planning, Economic projections, Governments, Water resources, Recreation, Power demand, Water policy, Natural resources, Water quality.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee and Illinois. The main purposes are to determine the need for further flood control measures and to enhance the economic well being of the Basin. This Appendix presents background information, planning concepts and procedures, and--as an end product--a generalized plan for the development and management of water and related land resources of the Basin. The study region comprises 163,000 square miles and is rich in water, mineral and other resources. Population will triple by the 21st Century, with water use and demand increasing greatly for such activities as electric energy requirements, recreation, municipal and industrial water use, hunting and fishing, and water-borne freight. Flood control improvements will be needed. Control of stream flows and coordinated development and use of streams and impounded waters will be important in meeting future demands on available resources. The proposed Framework Program plan would call for tripling reservoir storage capacity from 1980 to 2020, increasing hydroelectric capacity by the same amount, adding 15-30% more acreage to public lands to meet projected recreation demand, and the acceleration of all water-resource-oriented planning programs in existence to cope with this increased demand. (Arnold-NC)
W80-03571

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME X-APPENDIX I, ELECTRIC POWER.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 278, Price codes: A05 in paper copy, A01 in microfiche.

Prepared for the Ohio River Basin Coordinating Committee by the Federal Power Commission, 1966. 92 p, 13 Tab, 6 Exhibits.

Descriptors: *Water resources development, *Electric power, *Ohio River Basin, *Electric power demand, *Electric power production, *Cooling water, Water demand, Hydroelectric power, Water policy, Thermal power.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix assesses data for and predicts future demand for power in the Ohio Basin. Energy requirements for power generation in the Basin are expected to increase about 200% between 1963 and 1980 and an additional 370% between 1980 and 2020. Total generating capacity is expected to increase 225% between 1963 and 1970 and an additional 75% from 1970 to 1980, but no specific growth forecasts are given for 1980-2000. Hydroelectric development will increase somewhat, but then level off near the end of the century as nuclear power plays a greater role in meeting energy requirements. Available surface and ground water resources in the Basin appear to be sufficient to satisfy cooling water needs of thermal electric generation in the foreseeable future. With more energy efficient thermal plants coming on line by 1980, cooling water requirements will be gradually reduced. Because of unforeseen technical advances in power plants, exact predictions of cooling water requirements for the period beyond 2000 are not feasible at this time (1966). (Arnold-NC)
W80-03572

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME IX-APPENDIX H, OUTDOOR RECREATION.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 277, Price codes: A09 in paper copy, A01 in microfiche. Prepared by the U.S. Department of the Interior, Bureau of Outdoor Recreation for the Ohio River Basin Coordinating Committee, June 1966. 197 p, 4 Tab, 21 Plates, 4 Append.

Descriptors: *Water resources development, *Outdoor recreation, *Ohio River Basin, *Multiple purpose projects, *Recreation demand, Recreation facilities, Projections, Natural resources, Planning, Land use, Social aspects, Water policy, Economics.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly that portion in Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix assesses the demands and needs for water related outdoor recreation opportunities of the Basin by regional summary and for each of the Basin's subareas in the years 1980, 2000, and 2020. All 19 subareas have a need for additional development to meet future needs. For the 3 target years, demands will increase more than 2-fold, 4-fold, and 6-fold, respectively, over 1960 demands. Recreation needs by 2020 are projected to be 971.3 million recreation days, with resource requirements estimated to be up to 8,741,700 land acres and 9,207,900 water acres by 2020, at development costs of up to $4,370,800. The report recommends planning and development programs for all 19 subareas, with special attention given to 7 subareas. Detailed studies of navigation waterways should be undertaken to determine the extent they can be used to alleviate recreational needs; scenic roads and parkways should be developed, and potential scenic riverways studied to determine their recreation capabilities; and recreational programs of all agencies administering recreation facilities should be considered in future planning. (Arnold-NC)
W80-03573

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VIII-APPENDIX G, FISH AND WILDLIFE RESOURCES.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 276, Price codes: A06 in paper copy, A01 in microfiche. Prepared by the U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, and Bureau of Commercial Fisheries for the Ohio River Basin Coordinating Committee, 1963. 99 p, 8 Tab, 8 Plates, 12 Photographs, 3 Supp

Descriptors: *Water resources development, *Fish and wildlife, *Multiple purpose projects, *Ohio River Basin, *Fish management, *Commercial fishing, *Sport fishing, *Hunting, *Wildlife management, Freshwater fish, Fisheries, Natural resources, Aquatic life, Planning.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin System, particularly that portion in Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. The purpose of this Appendix is to analyze fish and wildlife resource problems in the Basin and to furnish general solutions, particularly related to potential water development projects. Gross demand for sport fishing will increase 62% by 1980, 88% by 2000, and 138% by 2020 over 1960 actual Basin use. Hunter demand will also increase though at a slower rate--32% by 2020. Neither fish nor game resources will be adequate to meet these needs. Expanding human populations limit the Basin's habitat base. Providing for projected 1980 fishing needs could involve an annual estimated expenditure of $1,100,000-$3,900,000. Projected sub-basin sport fishing needs could be met by: creating ponded waters; improving water quality by curbing pollution; providing equitable zoning of use on available waters; rehabilitating or reclaiming fishing waters; acquisition of greater public access to fishing waters; planning for future needs; and avoiding degradation of habitats. Future hunter needs could be met by more intensive management of public hunting lands; introduction of new species; opening new hunting lands; and planning. (Arnold-NC)
W80-03574

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VII-APPENDIX F, AGRICULTURE.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6D.
W80-03575

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME III-APPENDIX B, PROJECTIVE ECONOMIC STUDY.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6A.
W80-03579

OHIO RIVER BASIN--COMPREHENSIVE SURVEY: VOLUME II-APPENDIX A, HISTORY OF STUDY.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6D.
W80-03580

DESIGNING FOR DEVELOPMENT: WHAT IS APPROPRIATE TECHNOLOGY FOR RURAL WATER AND SANITATION.
D. Henry.
Water Supply and Management, Vol 2, No 4, p 365-372, 1978. 1 Fig.

Descriptors: *Rural water supply, *Developing countries, *Water technology, *Rural areas, *Water resources development, *Water supply development, Technology, Water supply, Strategies, International Development Research Centre, Costs, Planning, Resources development, Research and development.

In developing countries 90% of the populations live in rural areas. In these societies the non-conventional energy sources are the electric motor and diesel engine and the conventional energy sources are animal and human power, sometimes supplemented by wind and water power. Women carry almost 100% of the water for domestic purposes, spending more than 50% of their time doing so. The International Development Research Centre has been conducting research of rural water technology. Their research philosophy focuses on: (1) national priority; (2) utilization of local personnel and resources; (3) rural emphasis; (4) applicability, and (5) research training. A major problem in rural areas is that these people do not have a revenue collection system through which payments for both capital and operating costs of rural water supply programs can be collected. One of the most essential tools in the rural water field will be an effective system for the generation, collection and dissemination of information. Basic criteria for selection of rural water technology are that any technology must be capable of fabrication within the developing country; and that it must be reliable, have a reasonable cost and be maintainable by villagers. The most difficult part of the appropriate technology equation is getting the technology into the marketplace after the design has been tested and optimized. In developing rural water systems the challenge is to produce machines that will make poor people more productive and to ensure that the villager becomes an active member of the research team since he is the focal point of all this activity. (Iervolino-NC)
W80-03592

IDENTIFYING RESEARCH PRIORITIES IN WATER DEVELOPMENT,
R. Chambers.
Water Supply and Management, Vol 2, No 4, p 389-398, 1978. 11 Ref.

Descriptors: *Research priorities, *Water resources development, *Rural water supply, *Water demand, Water supply, Developing countries, Productivity, Equity, Rural areas, Planning, Decision-making, Social aspects, Research and development.

Factors influencing priorities in water-related research are discussed, along with complementary and corrective approaches, and examples of the kinds of priorities which might emerge. The focus concerns improving the levels of living of the people, especially the poorer people, in rural areas of the third world. Professional training and prestige, biases of dominance, difficulties of studying water, and the problem-orientation are factors which influence priorities in water-related research. In determining research priorities, more specific criteria might include productivity, equity, stability, quality of life, and non-seasonality. A suggested water research and development approach to counterbalance current biases would include five main complementary elements: (1) working with and learning from rural people; (2) holistic appraisal; (3) opportunity orientation; (4) creative lateral thinking; and (5) practicality. Changes following on from water-related research might help rural development generally and the poorer rural people in particular. Some priorities for research include water reform, traditional domestic technologies, water-appropriating technology, water conservation and storage, and slack resources for the poor. The potential for increased agricultural production and more equitable distribution of water to farmers on existing irrigation systems is enormous. Organization and management of irrigation bureaucracies is needed to ensure more productive and equitable distribution of water. The design and choice of pump technology has great potential and needs to be investigated further. Obvious opportunities are presented by reducing evaporation from open bodies of water, reducing seepage from channels, dams and tanks, and the artificial recharge of groundwater. (Iervolino-NC)
W80-03594

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMICS OF IRRIGATION AND THE INSTITUTIONAL AND PRICING SYSTEMS OF WATER IN ISRAEL,
Hebrew Univ., Rehovot (Israel). Faculty of Agriculture.
D. Yaron.
Agricultural Water Management, Vol 2, No 3, p 203-216, Nov 1979. 1 Fig, 3 Tab, 30 Ref.

Descriptors: *Economic efficiency, *Irrigation efficiency, *Pricing, *Planning, Institutional constraints, Market value, Water rates, *Israel, Water conservation, Water Resources Development.

Economic analyses of irrigation performed in Israel show the many facets and complexities of ascertaining the value of irrigation water. This paper reviews some of the relationships existing between progress made in the economics of irrigation and the institutional framework and system of water pricing. Israel provides a good example because of its fast rate of development of irrigated land, adaptation and/or development of advanced irrigation methods, and the scarcity of irrigation water which emphasizes the need for an efficient use of this resource. It is suggested that the essence of the relationships discussed is that under conditions of water scarcity and the existence of a conceptional understanding of the economic relationships involved in irrigation, pressure develops to adapt the institutional and pricing systems to obtain a more rational use. This adaptation process must overcome resistance typical of any institutional framework and the pressure of opposing interest groups. (Tickes-Arizona)
W80-03554

MANAGING SMALL WATER SYSTEMS: A COST STUDY, VOLUME II,
ACT Systems, Inc., Winter Park, FL.
J. I. Gillean, W. K. Adams, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126410, Price codes: A14 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-147b, September 1979. 304 p, 25 Fig, 4 Tab, 2 Ref, 3 Append. 68-03-2071.

Descriptors: *Cost-benefit analysis, *Econometrics, *Water costs, *Data collections, Utilities, Water works, Water rates, Taxes, Water delivery, Labor, Regression analysis, Productivity, Maintenance costs, Water supply, Depreciation.

Financial data and operations are reported for 23 selected small water utilities. Data are given for a 10 year period for support services, acquisition, treatment, delivery, chemicals, payroll, and power. These data are analyzed in Volume I in which depreciation expense is examined for each of the above as to its relative capital intensiveness. To allow for comparisons between utilities the amount of revenue-producing water is used in all calculations. Cost analyses show that distribution remains the most significant cost component. Labor costs, a major part of total operational and maintenance costs, have more than doubled in many cases for the period studied. Labor costs and productivity are mathematically related to capital productivity and costs to examine the cost impact of increased output in terms of payroll and captial expenditures. Inflation effects are also analyzed in Volume I for the utility budgets. A cost analysis summary for the last year of record is given for 23 utilities. Brief Descriptions of the individual utilities are given including location, operation, and a schematic diagram of the system used. Extensive printouts of data for each utility are included. (Seigler-IPA)
W80-03568

6D. Water Demand

BETTER UTILIZATION OF GROUND WATER IN THE PIEDMONT AND MOUNTAIN REGION OF THE SOUTHEAST,
Geological Survey, Raleigh, NC. Water Resources Div.
R. C. Heath.
In: Water Conservation and Alternative Water Supplies--Proceedings of a Southeast Regional Conference, November 8-9, 1978, Georgia Institute of Technology, p 145-160, 1979. 10 Fig, 4 Ref.

Descriptors: *Water utilization, *Groundwater, *Southeast U.S., *Water supply, Surface waters, Water demand, Projections, Planning, Groundwater resources, Domestic water, Wells, Cities, Municipal water, Industrial water, Reservoir silting, Water requirements, Water table, Bedrock, Precipitation(Atmospheric), *Piedmont region, *Blue Ridge Mountain region.

Ground water in the Piedmont and mountain region of the Southeast, United States, is widely used for rural domestic, small municipal, and industrial water supplies. Surface reservoirs are the primary source of water for large cities and industries. Water use is expected to triple in the next 40 years and during this period many of the best reservoir sites will be occupied by cities, industries, and other high-cost developments and the yield of existing reservoirs will be reduced by sedimentation. Meeting the water needs of the region will require intensive development of ground water to supplement supplies from reservoirs. (See also W80-00001) (Kosco-USGS)
W80-03327

AN ANALYSIS OF WATER RESOURCES CONSTRAINTS ON POWER PLANT SITING IN THE MID-ATLANTIC STATES,
National Center for the Analysis of Energy Systems, Upton, NY.
B. F. Hobbs, and P. M. Meier.
Water Resources Bulletin, Vol 15, No 6, p 1666-1676, December 1979. 3 Fig, 2 Tab, 21 Ref. DOE EY-76-C-02-0016.

Descriptors: *Water resources, *Water demand, *Powerplants, *Cooling water, *Northeast U.S., Model studies, Mathematical models, Water requirements, Water users, Evaporation, Consumptive use, Low flow, Low-flow augmentation, Water pollution, Thermal pollution, Environment, Environmental effects, Electric power, Electric power industry, *Mid-Atlantic states.

Expansion of the electrical generation system in the Pennsylvania-Jersey-Maryland power pool will impact, and be constrained by, inland water availability. Future interpretations of the Federal Water Pollution Control Act Amendments of 1972 regarding evaporative cooling towers for coastal power plants, offshore siting and energy centers, and the policies and public acceptability of low flow augmentation reservoirs were some of the issues examined in this paper using scenarios generated by the Brookhaven National Laboratory Regional Energy Facility Siting Model (REFS). REFS is a multicommodity, transshipment-location, linear programming model used to allocate power plants among counties in a power pool under a minimization of cost objectives. The solutions are sensitive to the water resources assumptions in the model. For the year 2000, the amount of low flow augmentation allowed in the region's river basins and whether off-shore siting becomes a reality are the two water resources related issues which most affect the scenarios. The results showed that decisions regarding specific water problems can have region-wide implications for water- and nonwater- related issues. (Sims-ISWS)
W80-03361

PLANNING FOR DEVELOPMENT OF GROUNDWATER AND SURFACE WATER RESOURCES,
Central Water Planning Unit, Reading (England).
For primary bibliographic entry see Field 2E.
W80-03450

SOCIO-ECONOMIC CHANGES AND DEVELOPMENT OF WATER RESOURCES IN SAUDI ARABIA,
King Abdulaziz Univ. Jeddah (Saudi Arabia). Dept. of Biology.
K. H. Batanouny.
In: Modeling, Identification and Control in Environmental Systems, p 935-950, North-Holland Publishing Company, 1978, 2 Fig, 7 Tab, 10 Ref.

Descriptors: *Saudi Arabia, *Water resources development, *Groundwater, *National economic development, *Water demand, *Arid lands, Regional development, Water table aquifers, Deserts, Water supply development, Oases, Desalination, Governments, Water supply, Water table, Wells.

Problems and constraints in matching Saudi Arabia's water resources needs to that country's greatly expanded level of economic development are explored. Summary reviews are given of Saudi oil production, national physical features, rainfall, groundwater resources, surface water, and city water supply. With more than 2.2 million sq km, representing about 1.5% of the land area of the earth and 5% of its arid zone, Saudi Arabia is the largest country in the world without a river, and rainfall there is too scanty in the largest portion of the country to sustain agriculture. Water scarcity is one of the country's chief constraints on national life, and water resources development accordingly has received highest government priority. Because groundwater is almost the only widespread water source (the cases of the Beduin population are supplied from groundwater sources) government attention is focused mainly on ways to sustain and improve water supply from the ground. The government has recently engaged in extensive inventorying, planning and feasibility studies in regard to groundwater supplies. In addition, a sea water desalination program began in 1965 and six desalting plants with a capacity of 12.86 million gallons/day are in operation. Finally, various water supply schemes for the country's villages have been implemented, including well-drilling and installation of motor-driven pumps. (Harris-Wisconsin)
W80-03502

MUNICIPAL WATER USE,
Utah Water Research Lab., Logan.
R. D. Hansen, H. H. Fullerton, and T. C. Hughes.
Utah Science, Vol 40, No 2, p 51-53, June 1979. 4 Fig, 8 Ref.

Descriptors: *Water demand, *Water utilization, *Municipal water, *Water rates, *Water consumption(Except consumptive use), Water distribution, Utah, Forecasting, Water conservation, Water loss, Optimum development plans, Semiarid climates, Water resources planning.

In the first such inventory since 1960, the water usage in 50 of Utah's largest municipal systems serving a combined population of 877,000, is described, including estimates of per capita use rates, water use determinants, and future water use rates. It is concluded that Utahns use considerably more water per capita than the national average, to some extent because of the semiarid climate and watering requirements of lawns and gardens. It is expected that increases in price and decreases in the average size of residential lots will precipitate a decrease in water usage. Municipal systems which now accept losses in their distribution systems will likely choose at some future time to reduce leakage in lieu of developing new supplies, for which reason it would appear inappropriate for planners to include a growthrate in per capita demands. (Tickes-Arizona)
W80-03551

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIII-APPENDIX L, NAVIGATION.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03570

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XII-APPENDIX K, DEVELOPMENT PROGRAM FORMULATION.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03571

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME X-APPENDIX I, ELECTRIC POWER.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03572

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME IX-APPENDIX H, OUTDOOR RECREATION.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03573

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VII-APPENDIX F, AGRICULTURE.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 275, Price codes: A03 in paper copy, A01 in microfiche. Prepared by the U.S. Department of Agriculture, Soil Conservation Service, Economic Research Service, and Forest Service for the Ohio River Basin Coordinating Committee, 1966. 173 p, 44 Tab, 5 Plates.

Descriptors: *Water resources development, *Multiple purpose projects, *Water requirements, *Forestry, *Land classification, *Ohio River Basin, *Agriculture, Reservoirs, Flood control, Water demand, Recreation, Fish and wildlife, Groundwater, Water resources, Water supply, Planning, Irrigation, Water conservation, Land management, Conservation.

This is part of a larger study undertaken to provide data for comprehensive planning for the Ohio River Basin, particularly for that portion within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance the economic well being of the Basin. This Appendix assesses the current status of agricultural resources in the Basin and provides projections for the future growth of agriculture in the region for the years 1980, 2000, and 2020. The water problems analyzed include floodwater and sediment damage to crops, rural lands and urban areas; impaired drainage of agricultural lands; agricultural drought problems and irrigation requirements; and water needs for livestock and other uses. The report includes a general description of the agricultural resource base and the agricultural economy. Demands for water and related land resource development are presented, including flood prevention, recreation, fish and wildlife, and water supply. The present status of water and related land resources is discussed and a discussion of water availability in upstream areas is presented. Specific needs and problems are discussed. Conclusions indicate that agricultural lands are available to meet expected demands to 2000; multiple use of lands should be increased; water yields are adequate for farm and rural use; proper land management is essential for conservation; production and sediment reduction; more reservoirs should be constructed and better water quality control should be exercised in upstream areas; and greater flood protection measures will also be needed. (Arnold-NC)
W80-03575

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME VI-APPENDIX E, GROUNDWATER.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 2F.
W80-03576

OHIO RIVER BASIN--COMPREHENSIVE SURVEY: VOLUME II-APPENDIX A, HISTORY OF STUDY.
Army Engineer Div. Ohio River, Cincinnati.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 270, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Ohio River Basin Coordinating Committee, August 1969. 147 p, 4 Tab, 1 Chart, 1 Attachment.

Descriptors: *Water resources development, *Ohio River, *Water supply development, *River basin development, *Multiple purpose projects, *Water resources planning, Framework studies, U.S. Water Resources Council, Legislation, Floods, Water management(Administrative), Regional development, Water policy, Water resources, Water requirements.

This is part of a larger study undertaken to provide a data base for comprehensive planning for the Ohio River Basin System, particularly within Ohio, Indiana, West Virginia, Kentucky, Tennessee, and Illinois. The main purposes are to provide for further flood control measures and to enhance economic well being of the Basin through water resource development. This Appendix details the history of the study, the authority under which it was established, and the policies and procedures followed. In planning and coordinating the study schedule, the Performance Evaluation and Review Technique (PERT) was employed. A Coordinating Committee consisting of representatives from seven federal agencies and each of the 11 states in the basin was established. Its principal functions were to provide a basis for full and continuing exchange of views; to advise and assist all participating agencies with regard to their objectives, work assignments and schedules; to assist in resolution of study problems as they arose; and to make periodic reviews of progress. Summaries are presented of each of the 15 meetings--which included public input--held by the Committee. Reviews are presented of federal and non-federal water and related land resource development programs which were presented for that portion of the basin in which the meeting was held. Study progress was reported at each meeting and any new information relating to the study was presented. Observer questions and comments were solicited at the end of each meeting. The Water Resources Council Guidelines for Framework Studies are included as an appendix to this volume. (Arnold-NC)
W80-03580

DESIGNING FOR DEVELOPMENT: WHAT IS APPROPRIATE TECHNOLOGY FOR RURAL WATER AND SANITATION.
For primary bibliographic entry see Field 6B.
W80-03592

IDENTIFYING RESEARCH PRIORITIES IN WATER DEVELOPMENT,
For primary bibliographic entry see Field 6B.
W80-03594

6E. Water Law and Institutions

WILD RIVER INVENTORY,
Heritage Conservation and Recreation Service, Philadelphia, PA.
J. G. Eugster.
Water Spectrum, Vol 12, No 1, p 28-37, Winter 1979, 13 Fig.

Descriptors: *Northeast U.S., *Rivers, *River Basin Development, *Wild Rivers, *Preservation Watershed management, Conservation, Water conservation, Water resources development, Protection, Land use, Watersheds(Basins), Regions, Topography, Water pollution control, River systems, Potomac River, Delaware River, Wild River Act, Scenery, Water policy.

A 13-state, Maine to Virginia, inventory of the Northeast was conducted to identify rivers for potential inclusion in the National Wild and Scenic Rivers System (NWSRS). The inventory, begun in 1975, identified more than 5300 miles along 171 rivers that are in relatively natural condition and merit some type of protection, conservation, or preservation measures. Similar evaluations were made in the Southeast and Lake Central Regions. For inclusion in NWSRS a river must be free-flowing, free of certain types of alterations, be largely undeveloped, and be adjacent to a related land area that possesses multi-state or national significance. Categories of information inventoried and evaluated include descriptive, geological-ecological, wilderness, scenic, cultural, and recreation. Most rivers identified are in the northern and southern extremes of the Northeast Planning Region (Virginia, West Virginia, and Maine) away from major urban areas. However, more than 9% of the river miles identifired are within 50 miles of cities of 50,000 or more. The rivers are identified by state and physiographic section. Eighty-five percent of the rivers identified are medium-to-small-sized. Of the large rivers only about 825 miles of the Potomac, Penobscot, Delaware, and St. Croix Rivers were identified. The Northeast has the smallest number of rivers in the NWSRS compared to all other areas in the continental U.S. Already in the system are portions of the Delaware and Allagash Rivers. Major benefits of the inventory are listed including: making information available, identifying preservation opportunities, and building a communications network. (Seigler-IPA)
W80-03317

GROUNDWATER RIGHTS IN VERMONT: DRINKWINE V. STATE,
J. P. Sahl.
Vermont Law Review, Vol 4, No 1, p 189-202, Spring 1979.

Descriptors: *Vermont, *Groundwater availability, *Absolute ownership doctrine, Groundwater, Groundwater resources, Judicial decisions, Prior appropriation, Reasonable use, Correlative rights, Water management(Applied).

The state of Vermont follows the absolute ownership doctrine of groundwater allocation. This means a surface owner has virtually unrestricted ownership and use of groundwater beneath his property. The doctrine, and the Vermont Supreme Court's recent reaffirmation of it are the subject of this commentary. The historical development of absolute ownership is reviewed, and the alternative doctrines of reasonable use, prior appropriation and correlative rights are considered. Modern developments in hydrology have significantly undermined the rationale for adherence to the absolute ownership rule because the movement and quantity of groundwater is now ascertainable. Every state, except Vermont, that follows the absolute ownership rule has modified it to exclude waste and malicious diversion. Pollution and depletion of groundwater supplies are other problems inadequately handled today by the absolute ownership doctrine. The correlative rights doctrine is the favored alternative. In addition, comprehensive legislation and a strong administrative agency is advocated as the best approach to solving water problems in general and groundwater problems in particular. (MacGregor-Florida)
W80-03403

WATER RESOURCES COMMITTEE (ANNUAL REPORT): SURVEY OF WYOMING WATER LAW 1975-78.
American Bar Association, Washington, DC.
Natural Resources Lawyer, Vol 12, No 1, p 311-326, 1979.

Descriptors: *Wyoming, *Judicial decisions, *Legislation, *Administrative decisions, Dams, Water rights, Appropriation, Water transfers, Irrigation, Groundwater, Water law.

The most significant Wyoming water law passed in 1975 was the law creating the Wyoming Water Development Program. This statute establishes procedures whereby the state can actively become involved in the construction and operation of water development projects. An important session law in 1976 authorized the appropriation of $250,000 to the attorney general for maintaining Wyoming's rights to the state's waters. Numerous session laws were paned in 1977 dealing with the determination of water rights, appropriation, water projects, plant siting and dam inspection. In 1978, the legislature authorized the Department of Economic Planning and Development to proceed with the construction of a well supply and water transmission project. The judicial activity in Wyoming is also reviewed. The Supreme Court held that owners of reservoirs are not subject to absolute liability for damage done by escaping water. These

were several major decisions by administrative boards. A change from irrigation use to steam power plant use was approved. Another change in appropriations from irrigation to preferred industrial use was granted. Groundwater storage by the Conservation District was also approved. (Quarles-Florida)
W80-03404

WATER QUALITY COMMITTEE (ANNUAL REPORT).
American Bar Association, Washington, DC.
For primary bibliographic entry see Field 5G.
W80-03405

FLOODPLAIN AND WETLANDS MANAGEMENT (FINAL RULE).
National Aeronautics and Space Administration, Washington, DC.
Federal Register, Vol 44, No 3, p 1089-1092, January 4, 1979.

Descriptors: *Floodplains, *Wetlands, *Management, Public rights, Maintenance, Regulation, Environmental control, Federal government, Permits.

This final rule provides guidelines and details procedures to the National Aeronautics and Space Administration (NASA) headquarters and field installations for the uniform implementation of Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands. NASA has a limited scope of activities in floodplain and wetland areas, the latter being subject to management by the United States Fish and Wildlife Service. The rule encompasses the responsibility of NASA officials, general implementation requirements and procedures for evaluating NASA actions impacting floodplains and wetlands. The rule is intended to assure: (1) that harm to lives, property and floodplain values is properly minimized; (2) that applicants for facilities use permits and grants evaluate the effect of their proposals on floodplains and wetlands prior to NASA approval; and (3) that proper restrictions are placed on property proposed for lease, easement and disposal to non-federal public or private parties. The rule defines and expands the public audience and ensures their continuous involvement in floodplain decision-making. (Corey-Florida)
W80-03406

PUBLIC USE OF WATER RESOURCES DEVELOPMENT PROJECTS ADMINISTERED BY THE CHIEF OF ENGINEERS (FINAL RULE).
Corps of Engineers, Washington, DC.
Federal Register, Vol 44, No 47, p 12671-12679, March 8, 1979. 2 Append.

Descriptors: *Water resources development, *Public access, *Recreation, Water resources, Regulation, Swimming, Camping, Hunting, Fishing, Trapping, Lakes.

The Department of the Army, acting through the Chief of Engineers, published more effective management of Corps of Engineers water resource development projects. The purpose of these rules is to clarify and strengthen existing rules and regulations and eliminate duplication of regulations. Part 327 of the final rule governs public use of water resource development administered by the chief of engineers. These regulations cover the following items as well as others: policy; vehicles, vessels; swimming; camping; hunting; fishing; trapping sanitation; fires; restrictions; explosives, firearms, other weapons and fireworks; abandonment of personal property; advertisements; outgranted lands; recreation use fees; and lakeshore management of Civil Works Projects. These regulations apply to water resource development projects completed or under construction, administered by the Chief of Engineers, and to those portions of jointly administered projects under the administrative jurisdiction of the Chief of Engineers. (Walker-Florida)
W80-03407

CONSISTENCY FOR DEPARTMENT OF THE INTERIOR OUTER CONTINENTAL SHELF (OCS) PRELEASE SALE ACTIVITIES AND FOR OTHER FEDERAL ACTIVITIES DIRECTLY AFFECTING THE COASTAL ZONE (FINAL RULE).
National Oceanic and Atmospheric Administration, Washington, DC.
Federal Register, Vol 44, No 123, p 37142-37161, June 25, 1979.

Descriptors: *Continental shelf, *Management, *Coasts, Public rights, Leases, Federal jurisdiction, State jurisdiction, Permits, Regulation, Environmental control.

This final rule amends existing regulations to conform with the April 20, 1979 United States Justice Department opinion. This opinion concluded that the Department of the Interior's Outer Continental Shelf (OCS) prelease sale activities which directly affect the coastal zone must be undertaken in a manner consistent, to the maximum extent practicable, with the requirements of approved coastal management programs in accordance with Section 307(c)(1) of the Coastal Zone Management Act (CZMA), as amended. The opinion further provided that the phrase 'directly affecting' in Secton 307(c)(1) of the CZMA, which specifically applies to OCS prelease sale activities, should be included in the regulations, instead of using present language such as 'significantly' affecting the coastal zone in terms of 'primary', 'secondary', and 'cumulative' impacts. The amendments to the regulations also include minor editorial modifications and corrections and became effective June 25, 1979. (Corey-Florida)
W80-03408

PROCEDURAL CONSIDERATIONS IN THE JUDICIAL DETERMINATION OF WATER DISPUTES,
T. Toner.
Land and Water Law Review, Vol 8, No 2, p 513-535, 1973.

Descriptors: *Water rights, *Wyoming, *Judicial decisions, Appropriation, Remedies, Jurisdiction, Water law, Water allocation(Policy), Water policy, Legal aspects.

An appropriative water right is an exclusive right to use water appropriated according to the law and applied to a beneficial use. Suits to protect these rights have taken many different forms in Wyoming: (1) actions seeking quiet title relief; (2) declaratory judgments; (3) damages; (4) injunctions to prevent wrongful diversions; (5) writs of mandamus; and (6) mandatory and preventive injunctions against water officials. Of course, relief requested by some plaintiffs includes a combination of these different remedies. Procedural problems relating to jurisdiction, parties, pleadings, and forms of relief which arise in water disputes are examined. For jurisdiction, the issues of power, competence and venue, and primary jurisdiction are considered. Considered as parties to suits are water officials and water distribution agencies. The unigue nature of an appropriative water right causes a number of procedural problems, when a suit to protect such rights is forced into forms of action designed to protect different kinds of rights and property. (Walker-Florida)
W80-03411

U.S. CORPORATE RESPONSE TO ENVIRONMENTAL OBJECTIVES,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
J. O. McDonald.
Earth Law Journal, Vol 3, Issues 1-4, p 156-163, 1977.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Water pollution control, Permits, Legislation, Environment, Effluents, Penalties(Legal).

The major problem with past pollution legislation has been lack of specificity. The 1972 Federal Water Pollution Control Act Amendments were badly needed. They have far reaching results for industry, government and the public. The National Pollutant Discharge Elimination System (NPDES) program is a major new source of regulation. This is a permit program based on effluent requirements. Schedules for control of effluent are also included. The program calls for state-federal implementation and enforcement. The permit is treated as if it were a contract. The past laissez-faire arrangement between polluters and administrators is gone. Penalties include fines of $25,000 per day and one year in jail for the first offense and $50,000 in fines and two years in jail for subsequent offenses. A major effort is needed to increase public awareness of pollution control and clean-up legislation. These amendments may accomplish this, as they provide for citizen suits and the awarding of court costs and attorney fees to either side. (Walker-Florida)
W80-03412

WATER RESOURCES COMMITTEE REPORT ON WATER LAW DEVELOPMENTS,
American Bar Association, Washington, DC.
Natural Resources Lawyer, Vol 6, No 3, p 439-471, Summer 1973.

Descriptors: *Water law, *Administration, *Legislation, *Judicial decisions, State governments, Legal aspects, Water policy, Water management(Applied), Water rights, Watercourses(Legal aspects).

Summarized are significant developments in the field of water law and water administration in the United States for the period from August 15, 1972 to March 15, 1973. The information is presented on a state by state basis. Each summary pertains to legislative, judicial and administrative matters, as appropriate. The information was prepared by a Water Resources Committee member designated in each state. States for which there was no significant developments within the time period include: New Hampshire, Arizona, Wisconsin, North Carolina, North Dakota, Oregon, New Mexico and New York. (Walker-Florida)
W80-03413

UNITED STATES OCEAN MINERAL RESOURCE INTERESTS AND THE UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA,
Department of the Interior, Washington, DC. Office of the Assistant Secretary for Energy and Minerals.
L. S. Ratiner, and R. L. Wright.
Natural Resources Lawyer, Vol 6, No 1, p 1-43, Winter 1973.

Descriptors: *Law of the Sea, *Resources development, *International waters, Mining, Oil, Mineral industry, Industries, Legislation, United Nations, United States.

An overview is presented of the challenges facing negotiators at the third United Nations Conference (Conference) on the Law of the Sea. Reference is made to previous conferences and their results. Major emphasis is placed on the effect that the third conference is likely to have on the distribution of ocean mineral resources. This problem is divided into the two categories of petroleum and hard minerals. For each of these resources the following are considered: (1) U.S. interest in the resource; (2) U.S. position; (3) other countries' interests in the resource; and (4) progress of the negotiations. Until a final treaty is adopted, the mining industry suggests that interim deep sea mining legislation be passed. The industry's arguments are: (1) The United States (U.S.) should develop a politically secure source of important metals; (2) Ocean mining will lead to new important technology; (3) Deep sea mining will improve U.S. balance of payments; (4) Treaty negotiations are slow and unlikely to produce reasonable results; (5) The U.S. is using deep sea mining as a trading coin to achieve other objectives in the conference; and (6) Deep sea interim legislation will help achieve an international regime and organization. (Walker-Florida)
W80-03415

THE NATIONAL ESTUARINE SANCTUARY PROGRAM,
National Oceanic and Atmospheric Administration, Washington, DC.
J. W. Mac Farland, and R. S. Weinstein.
Coastal Zone Management Journal, Vol 6, No 1, p 89-97, 1979. 12 Ref, 1 Append.

Descriptors: *Estuarine environment, *Marsh management, *Coastal marshes, Coasts, Estuaries, Ecosystems, Federal government, Management, Environmental effects, Grants.

In the 1972 Coastal Zone Management Act Congress established the Estuarine Sanctuary Program. This program arose in response to two government studies showing that estuaries are economically and ecologically valuable to man and in danger of being physically altered and polluted. The program makes available a fifty-percent matching grant to coastal states to help them set aside estuarine areas for research and education. The information gained within these areas will aid in future management decisions concerning the coastal zone. The sanctuaries are established and operated under the Estuarine Sanctuary Guidelines. Grants are available for preacquisition, acquisition, and operations. Presently, there are five sanctuaries in operation, with others in the planning stage. The five established sanctuaries are in South Slough, Oregon, Sapelo Island, Georgia, Wainance Hawaii; Old Woman Creek, Ohio; and Rookery Bay, Florida. Proposed sites are in Apalachicola Bay/River, Florida and Elkhorn Slough, California. A reference list is included. (Walker-Florida)
W80-03416

ADVERSE EFFECTS OF RECREATION ON SAND DUNES: A PROBLEM FOR COASTAL ZONE MANAGEMENT,
Environmental Research Associates, Seattle, WA.
G. Vogt.
Coastal Zone Management Journal, Vol 6, No p 37-68, 1979. 3 Fig, 60 Ref.

Descriptors: *Dune sands, *Recreation demand, *Carrying capacity, Coasts, Management, Dunes, Environmental effects, Land use, Shores, Coastal structures.

The conflict between two goals of coastal zone management are dealt with: preservation of and increased access to the shoreline for recreation purposes. Foot traffic and off-road vehicles are examples of recreational activities which can harm dune areas. The concepts of ecological and perceptual carrying capacity are discussed. The former deals with the environment's assimilative capability, while the latter focuses on the recreationist's perception of environmental quality. Coastal zone management policies of certain federal, state and local government entities are examined. Attention is focused on state regulations in California and Oregon with local coastal management programs in Washington state receiving mention. A two-stage methodology is proposed to aid in decision-making on the local governmental level. In the first stage, a decision must be made as to whether increasing access to the coastal zone for recreation is more or less important than protecting the coastal resource. Decision stage two deals with how the coastal resource is allocated to different recreation uses and what management tools can be used in making allocation decisions. An implementation scenario is also proposed. (Walker-Florida)
W80-03417

DEVELOPING MANAGEMENT GUIDELINES FOR OIL AND GAS ACTIVITIES: THE LOUISIANA EXPERIENCE,
Louisiana State Univ., Baton Rouge.
J. H. Stone, L. M. Bahr, Jr., J. W. Day, Jr., R. E. Turner, and P. H. Templet.
Coastal Zone Management Journal, Vol 6, No 1, p 9-35, 1979. 1 Fig, 1 Tab, 30 Ref.

Descriptors: *Louisiana, *Water pollution control, *Resources development, Management, Oil industry, Coasts, Natural gas, Environmental effects, Estimating benefits, Estimating costs.

Preliminary management guidelines have been derived for oil and gas activities in coastal Louisiana. Passage of the federal Coastal Zone Management Act resulted in a planning program to develop a Coastal Zone Management Plan for Louisiana. A general premise was that all economic activities should be designed to complement natural functions as much as possible. The process by which the guidelines for the oil and gas industry were established is analyzed. A step-by-step method is described as follows: (1) agree that there are environmental impacts; (2) estimate the extent of the impacts; (3) establish guidelines to deal with the impacts; (4) solve technical problems associated with guidelines; (5) transfer and implement procedures or guidelines; and (6) enforce the guidelines. Included with this process analysis is a discussion of the implications for coastal zone management. A series of tables outlines the coastline impacts of activities relating to oil and gas exploration, construction, production and ancillary development. Guidelines are listed to reduce these impacts and their unknown effects. (Walker-Florida)
W80-03418

NATIONALIZING LAKE TAHOE.
Santa Clara Law Review, Vol 19, No 3, p 681-717, Summer 1979.

Descriptors: *Federal government, *Land management, *California, *Nevada, Administrative agencies, Basins, Urbanization, Planning, State governments, Land use, Recreation.

As a result of urbanization in the Northern California and Northwestern Nevada area, concern arose for the preservation of the Lake Tahoe Basin area as a beautiful recreation attraction. In response to this concern, a planning board, the Tahoe Regional Planning Agency (TRPA), was created pursuant to an agreement between California and Nevada with Congressional approval. Recently, the TRPA's effectiveness has been questioned. Any resolution of the problem has been stymied due to the disagreement between the two states' legislatures. Federal intervention has been threatened to resolve the dispute. Various methods of federal intervention are examined. The creation of a national recreation area is stressed with the imposition of federal land use controls as a means to protect the basin, in the absence of effective state land management controls. There is a wealth of federal power available to affect the area's growth. Apparently, Congress has the constitutional power to impose direct federal land use control to protect any federal land. At the very least, a congressional declaration of the national interest in Lake Tahoe should be made. (Quarles-Florida)
W80-03419

SOUTH DAKOTA GROUND WATER AND THE ARTESIAN PRESSURE: IS THE USE OF WATER FOR DOMESTIC PURPOSES STILL THE HIGHEST USE.,
G. L. Peterson.
South Dakota Law Review, Vol 24, No 3, p 772-794, Summer 1979.

Descriptors: *South Dakota, *Domestic water, *Artesian wells, Constitutional law, Groundwater availability, Compensation, Water law, Groundwater resources, Water demand.

Before 1972 it was South Dakota's policy to protect the artesian pressure as a means of diversion of ground waters. A 1972 amendment to the state's water law changed this policy. As a result of a priority dispute over the use of the artesian pressure, the amended statute tips the balance in favor of the large-scale user and away from the domestic user. The framework of a constitutional challenge is analyzed. The assertion is that valuable property rights to the beneficial use of the water have been taken without compensation. An examination of alternative theories that a domestic user may argue in asserting his right to the artesian pressure is also presented. Common law theories such as nuisance and negligence may be argued, but a more feasible approach would be to advocate a statutory change. Domestic wells should be regulated to phase out 'freeloading', archaic wells. A statutory definition of adequacy more common to the average layman should be provided, taking into account existing wells and the state of development in the area. (Walker-Florida)
W80-03420

THE GROWING NEED FOR FEDERAL-STATE COOPERATION IN MANAGING THE SEA,
Marine Mammal Commission, Washington, DC.
D. Laist, and J. Epting.
Coastal Zone Management Journal, Vol 6, No 1, p 1-7, 1979.

Descriptors: *State governments, *Oceans, *Regulation, *Governmental interrelations, Submerged Lands Act, Coasts, Jurisdiction, Water resources, Coordination, Management.

As the number of federal marine management programs and authorities proliferates, at least two concerns become immediately apparent. First, the separate pieces of enabling legislation for these programs do not combine into a cohesive whole. They are a series of piecemeal initiatives each defining a specific, though often overlapping, marine mission. This creates the problems of inefficient work and bureaucratic tracking of progress within other programs. Several studies are referred to which investigate the need for a more comprehensive and integrated national ocean management system. The second concern is the recognition of the current and essential state role in marine management. This arises because the three-mile limit controlled by the states contains a major segment of the overall marine resources. The states also control the condition of the environmentally sensitive estuarine and near-shore environments. The states have been given broad federal mandates under the Submerged Lands Act and the Coastal Zone Management Act. For these reasons, a more viable state role in marine management is advocated. (Walker-Florida)
W80-03421

SAFEGUARDS FOR GROUNDWATER,
J. Josephson.
Environmental Science and Technology, Vol 14, No 1, p 38-44, January, 1980. 2 Fig.

Descriptors: *Water pollution control, *Ground water, *Regulations, Landfills, Injection wells, Impoundments, Pollutants, Wastes, Monitoring, Sampling, Attenuation.

Approximately 50% of the U.S. population depends upon ground water. Due to its slow movement and lack of oxygen, ground water tends to be a contaminant preservation medium. Contaminant mobility depends upon oxidation-reduction potentials, complementary ions, and the presence of clays. Contaminants can be contained or intercepted by pumping but this will require treatment of pumped ground water or discharge of untreated ground water. The best approach to ground water protection would be to prevent contamination due to improper land-filling, underground injection, and surface impounding of hazardous wastes. The EPA acting under the Safe Drinking Water Act of 1974 (SDWA) and the Resource Conservation and Recovery Act of 1976 (RCRA) will enforce strict regulations governing disposal of wastes. This will affect 275,000 waste generators, 30,000 facilities, and about 10,000 waste transporters. In addition there will be rules, guidelines and recommendations for monitoring ground water. For example, sampling must avoid contact with atmospheric air and the monitoring/sampling equipment should not react with the suspected contaminants. Analyses performed by an EPA-certified laboratory would have greater credibility in a dispute. (Purdin-NWWA)
W80-03422

EXECUTIVE SUMMARY OF THE REPORT 'SURFACE IMPOUNDMENTS AND THE EFFECTS OF GROUND WATER QUALITY IN THE UNITED STATES--A PRELIMINARY SURVEY'.
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 5B.

W80-03424

EPA'S HAZARDOUS-WASTE PROGRAM: WILL IT SAVE OUR GROUND WATER,
For primary bibliographic entry see Field 5E.
W80-03431

DAM SAFETY: THE CRITICAL IMPERATIVE,
Western New England Coll., Springfield, MA.
D. Binder.
Land and Water Law Review, Vol 14, No 2, p 341-392, 1979.

Descriptors: *Dam failure, *Safety factors, *Dam construction, Dams, Governmental interpretation, Federal-State-Water rights conflicts, Legislation, Administrative agencies, Interstate rivers, Dam sites, Inspection.

The Carter administration is conducting a major reappraisal of Western water policy. A crucial area of consideration will be dam safety. The spectacular Teton dam break has been the most dramatic example of the seriousness of the dam safety problem. It was, however, only the culmination of a series of breaks and near-misses which have swept away congressional inaction. The result has been the Federal Dam Safety Inspection Act. This Act, proposed model codes, and existing state regulation are examined. The Teton disaster, its causes and lessons are also examined. States must enforce minimum safety and inspection standards. Present state programs are grossly inadequate. Because dams involve interstate waters and the present state regulations are inadequate a federal agency is proposed. (Mac Gregor-Florida)
W80-03499

THE THIRD UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA: THE SEVENTH SESSION (1978),
Miami Univ., FL. School of Law.
B. H. Oxman.
American Journal of International Law, Vol 73, No 1, p 1-41, January 1979.

Descriptors: *International law, *Law of the sea, *United Nations, *International waters, United States, Water law, Negotiations, Continental shelf, Oceans, Treaties.

The seventh session of the Third United Nations Conference on the Law of the Sea met in Geneva and New York during 1978. Most of the Informal Composite Negotiating Text (ICNT), except for part XI relating to deep seabed mining, survived review without further amendments. Aside from the deep seabed issues, there was no general disagreement on basic substantive questions. The United States along with other potential seabed mining countries rejected Part XI of the ICNT. Seven negotiating groups on outstanding issues were appointed at the session. Three groups dealt with deep seabed matters: the first, with the system of exploration and exploitation and resource policy; the second, with financial arrangements; and the third, with organs of the Seabed Authority. The fourth negotiating group dealt with access to living resources of the economic zone by landlocked states. The fifth group dealt with the settlement of disputes over fisheries in the economic zone. The sixth group attempted to define the outer limits of the continental shelf. The final group examined the delimitation of maritime boundaries between adjacent and opposite states and the settlement of delimitation disputes. (Quarles-Florida)
W80-03500

TIDELANDS AND THE PUBLIC TRUST: AN APPLICATION FOR SOUTH CAROLINA,
B. W. Wyche.
Ecology Law Quarterly, Vol 7, p 137-170, 1978.

Descriptors: *Tidal marshes, *South Carolina, *Court decisions, Wetlands, Land use, Marshes, Judicial decisions, Public rights, Water law.

Courts have generally applied the public trust doctrine to tidelands. Under the doctrine, tidelands, as well as lands underlying navigable, non-tidal waters, are held in trust for the benefit of the public. The owner is deemed to hold his title subject to the paramount rights of the public in the lands. In State v. Hardee (South Carolina), Justice Bussey of the South Carolina Supreme Court concurred with the result reached in the majority decision, but concluded in a separate opinion that only submerged lands are held in the public trust; the tidelands are merely 'vacant lots subject to grant and private ownership as any other vacant lands'. The main purpose of this article is to re-examine the conclusions drawn by Justice Bussey and others. By analyzing the common law, South Carolina statutory and case law, and the law in other jurisdictions, this article seeks to demonstrate that a tidelands trust does exist in the state. (Steiner-Mass)
W80-03526

INTEGRATED PLANNING FOR WATER QUALITY MANAGEMENT: THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 AND COASTAL ZONE MANAGEMENT,
Cornell Univ., Ithaca, NY. Dept. of City and Regional Planning.
W. K. Allayaud.
January 1979. 217 p, 55 Ref.

Descriptors: *Coastal zone management, *Federal Water Pollution Control Act Amendments, *Water quality, *Federal Coastal Zone Management Act, *Planning, *Water quality control, *Governmental interrelations, Management, Implementation, Land planning, Water management(Applied), Water permits, Water resources planning, Legislation.

The Federal Water Pollution Control Act Amendments were enacted by Congress in response to the severe water quality problems being faced by the nation. In addition to creating a permit system for dischargers and ordering grants for construction of sewage treatment plants, the Amendments place planning in a crucial role in the long-term effort to clean our waters. Section 208 of the Amendments establishes regional planning for water quality management as being necessary and provides strong incentives for states and municipalities to implement the Section's requirements. The Federal Coastal Zone Management Act of 1972 acknowledges the need to relate air, land and water planning in the coastal zones and gives the states the lead in order to provide comprehensive, coordinated management of coastal areas. These two processes--Section 208 and the Coastal Zone Management Act (CSMA)--need to be coordinated during implementation and the final planning outputs need to be integrated. There are five issues which relate to this integration. The first two issues on land and water planning integration and the role of different government levels are more general. The other three issues--coordination and integration of planning processes, sewage disposal in the coastal zone, and the 208 plan--deal more specifically with how the two planning processes come together. The author recommends that the states should play the lead role in the integration of water and land planning and they should also assume a stronger role in the system of federalism for resource management. Another major recommendation is that a final decision on ocean disposal of sewage should be postponed while continued planning helps to clarify the situation. Two case studies are presented. (Iervolino-NC)
W80-03581

THE CANADA WATER ACT ANNUAL REPORT, 1978-1979.
Department of the Environment, Ottawa (Ontario).
1979. 32 p.

Descriptors: *Water quality, *Water management(Administrative), *Flood damage reduction, *Basin studies, *Canada Water Act, *Water resources, *Water policy, *Legislation, Governments, Flood plain management, Basins, Nutrient loading, Watershed management, Hydrologic data, Flood-risk mapping, Flood protection, Monitoring, Flood damage, Water resources planning.

This is the seventh annual report covering operations to March 31, 1979. It outlines provisions of the 1970 Canada Water Act and discusses various government programs designed to carry out those provisions. Comprehensive water resource management included five major programs begun in 197m-1978 and implemented throughout 1978-1979. The flood damage reduction program identifies flood risks and potential damage in flood-prone areas, partially through an ongoing flood risk mapping effort. Construction activities included a dyking program in Southwestern Ontario and the Okanagan Flood Control Channel in British Columbia. Research activities pursuant to the Canada-Ontario Agreement on Great Lakes Water Quality also continued. The number of detected violations of nutrient loading limitations have declined since 1973. Public information programs included shoreline protection/flood hazard manuals, new data in the 1979 Canada Water Year Book, and television broadcasts on the flood damage reduction program. A description of the recent drought in Western Canada is presented. Eight implementation agreements on conducting of water basin agreements were reached and seven planning studies begun. (Arnold-NC)
W80-03583

6F. Nonstructural Alternatives

NATIONALIZING LAKE TAHOE.
For primary bibliographic entry see Field 6E.
W80-03419

TYPE 16 FLOOD INSURANCE STUDY: TSUNAMI PREDICTIONS FOR THE WEST COAST OF THE CONTINENTAL UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2E.
W80-03556

6G. Ecologic Impact Of Water Development

WATERFOWL PAIR USE OF NATURAL AND MAN-MADE WETLANDS IN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept of Wildlife and Fisheries.
J. J. Ruwaldt, Jr., L. D. Flake, and J. M. Gates.
Journal of Wildlife Management, Vol 43, No 2, p 375-383, April, 1979. 5 Tab, 22 Ref. OWRT A-038-SDAK(2), B-045-SDAK(2).

Descriptors: *Waterfowl, *Breeding, *Grasslands, *Potholes, Water levels, Water fluctuation, Blue-winged teal, Pintail ducks, Shoveler duck, Ponding, Wetlands, Freshwater marshes, Ecology, Ponds, Lakes, *South Dakota.

Prairie ponds and lakes, primarily of glacial origin, comprised 75 and 68%, respectively, of the total area and number of wetlands in South Dakota. Stock ponds comprised 14% of the area and 21% of the wetlands, and dugouts 1% and 12% of the wetland area and numbers, respectively. Semipermanent wetlands and stock ponds contained proportionally more pairs of most species than other wetland categories. Ephemeral, temporary, and seasonal wetlands were also heavily utilized by pairs, but contained smaller proportions of total pairs than semipermanent wetlands because of smaller surface water area. Permanent lakes received relatively low use in relation to surface water area. Ephemeral, temporary, and seasonal wetlands were part of a wetland complex utilized by Anatini. For several species of Anatini, loss of a portion of that complex as a result of drought apparently caused reduced pair use of the remaining semipermanent wetlands as well as stock ponds and dugouts. (Howard-Mass)
W80-03441

THE EFFECTS OF WATERFOWL MANAGEMENT PRACTICES ON MOSQUITO ABUNDANCE AND DISTRIBUTION IN LOUISIANA COASTAL MARSHES,
Louisiana State Univ., Baton Rouge.
S. C. Fleetwood, C. D. Steelman, and P. E. Schilling.
Mosquito News, Vol 38, No 1, p 105-111, March, 1978. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Salt marshes, *Marsh management, *Waterfowl, *Environmental effects, *Mosquitoes, Impoundments, Ecological distribution, Life history studies, Habitat, Insects, Wetlands, Wildlife management, Louisiana, Ecology.

Waterfowl management practices utilized in intermediate and brackish marsh impoundments produce significantly (P less than 0.01) more mosquitoes than practices utilized in marsh pump-outs or natural salt marsh in Louisiana. During the time that the impoundments were flooded, the intermediate marsh impoundment produced significantly (P less than 0.01) larger numbers of mosquitoes than the brackish marsh impoundment. Culex salinarius preferred the intermediate marsh impoundment. Anopheles bradleyi preferred the brackish marsh impoundment. During the time that the impoundments were drained (May through September), Aedes sollicitans eggs were collected in significantly larger numbers from the intermediate marsh impoundment. (Howard-Mass)
W80-03511

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE. PART B: CALIFORNIA, CASE STUDIES,
Jones and Stokes, Inc., Sacramento, CA.
C. Hazel, S. Herrera, H. Rectenwald, and J. Ives.
U.S. Fish and Wildlife Service, Office of Biological Service Report FWS/OBS-76/34. December, 1976. 606 p, 1 Append.

Descriptors: *California, *Wildlife habitat, *Water resources development, *Streamflow, Wildlife, Dams, Alternation of flow, Fisheries, Water resources, Fish management.

The results and conclusions are given for 47 case studies of California water projects that altered natural streamflow regimes and causally affected the fish and wildlife. Surveys were conducted on existing conditions below dams and diversions to assess the actual effects of the streamflow characteristics on fish and wildlife and to evaluate the adequacy of the methodologies used to determine necessary flows. (Steiner-Mass)
W80-03517

7. RESOURCES DATA

7A. Network Design

HYDROMETEOROLOGICAL MODEL FOR STREAMFLOW PREDICTION,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-03487

7B. Data Acquisition

AN AUTOMATIC RANGE-SWITCHING MODIFICATION FOR DIRECT-READING SPECIFIC CONDUCTANCE MEASUREMENTS,
Geological Survey, Denver, CO. Water Resources Div.
H. E. Taylor, and D. E. Erdmann.
Chemical, Biomedical, and Environmental Instrumentation, Vol 9, No 1, p 49-60, 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Automation, *Specific conductivity, *Measurement, *Instrumentation, Analytical techniques, Water sampling, *Automatic range-switching modification, Digital electronic circuitry, Direct-reading conductivity meter.

An analysis system was developed to determine automatically specific conductance on samples at the rate of 30 per hour over a range of 1 to 15,000 micromho per centimeter with a precision of 1 percent or less. The system consists of custom-designed digital electronic circuitry which modifies a commercially available direct-reading conductivity meter. This modification permits automatic range switching of the meter so that measurements are made under optimum conditions. (Kosco-USGS)
W80-03328

HYDROLOGIC LAND USE CLASSIFICATION USING LANDSAT,
Hydrologic Engineering Center, Davis, CA.
R. J. Cermak, A. D. Feldman, and R. P. Webb.
Technical Paper No 67, October 1979. 24 p, 5 Fig, 3 Tab, 8 Ref.

Descriptors: *Land classification, *Remote sensing, *Hydrology, *Satellites(Artificial), Land use, Hydrologic aspects, Watersheds(Basins), Runoff, Agriculture, Vegetation, Pasture, Industries, Water, Discharge(Water), Hydrographs, LANDSAT, Residential.

This report described the Hydrologic Engineering Center's experience with land use classification from LANDSAT multispectral imagery. Land use is required for the estimation of hydrologic model parameters. The land use classification procedure used, developed at the University of California, Davis, for the Corps of Engineers, is an unsupervised, noninteractive approach requiring no special image processing equipment. Watershed land use was determined from LANDSAT digital data, entered into a geographic data bank, and compared with a conventional land use classification. Hydrologic simulation model parameters were estimated from land use and other basin characteristics. The generated discharge frequency curves, corresponding to the alternative land use classifications, permitted the hydrologic significance of accuracy in land use identification to be assessed. (Humphreys-ISWS)
W80-03347

TV CAMERA LETS YOU LOOK DOWN A WELL,
C. Henry.
Irrigation Age, Vol 14, No 4, p 36-37, 45, January, 1980.

Descriptors: *Borehole cameras, *Irrigation wells, Logging(Recording), Photography, Remote sensing, Repairing.

Monitoring of irrigation wells with a downhole TV camera can quickly determine the cause of lost production or decreased flow and the best way to repair a well or fish for lost tools. It is also used by drillers to assure their customers that a new well was completed correctly, and by homeowners who want to convince prospective buyers that an old well is in good condition. With a black and white system a single conductor on a 1/4 in. line handles both camera and light source. The equipment can go as deep as 1700 ft. and withstand 200F water and artesian heads up to 2000 gpm. The picture transmitted from the well is a complete 360 degree view of the hole at about a 45 degree angle. A video tape of the well with a running commentary is made as the camera descends. Taping a normal well will cost between $250 and $500. (Purdin-NWWA)
W80-03423

DOWSING ACHIEVES NEW CREDENCE,
T. Williamson.
New Scientist, p 371-373, February 8, 1979. 1 Fig, 7 Ref.

Descriptors: *Groundwater, *Minerology, *Exploration, Magnetic studies, Geophysics, Structural geology, Remote sensing, Subsurface investigations.

A new method for mineral and ground water exploration, called the bio-physical method (BPM) in the Soviet Union or more commonly known as divining or dowsing, is being seriously investigated by some scientists. Hydrogeologists and other scientists concerned with ground water supplies have traditionally viewed water divining with distaste or hostility. This is due to the fact that most water diviners do not have even a basic understanding of ground water geology and perpetuate naive and unscientific theories about ground water and dowsing. Soviet geologists have been studying BPM for 12 years and have gotten as good or better results than obtained from geophysical methods. They theorize that the human nervous system is sensitive to very small anomalies in magnetic field strength caused by geologic discontinuities (faults, buried valleys, solution cavities, etc.). Mineral veins and ground water are often localized in such discontinuities. If the underlying principles of BPM were discovered, a simple, inexpensive water prospecting tool would be available to developing countries that depend on ground water. What is required is a thorough scientific investigation by a multidisciplinary team. (Purdin-NWWA)
W80-03432

MODEL FOR ESTIMATING ELECTRIC MACROANISOTROPY COEFFICIENT OF AQUIFERS WITH HORIZONTAL AND VERTICAL FRACTURES,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2F.
W80-03434

A HYDROLOGICAL ANALYSIS OF EAST AUSTRALIAN FLOODS USING NIMBUS-5 ELECTRICALLY SCANNING RADIOMETER DATA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
L. J. Allison, T. J. Schmugge, and G. Byrne.
Bulletin of the American Meteorological Society, Vol 60, No 12, p 1414-1427, December 1979. 13 Fig, 40 Ref.

Descriptors: *Rainfall, *Floods, *Australia, *Remote sensing, Satellites(Artificial), Rivers, Watersheds(Basins), Soils, Soil moisture, Microwaves, Runoff, Drainage, Hydrology, Meteorology, Microwave brightness temperatures, Scanning microwave radiometers.

The chronological development and diminution of six floods in eastern Australia during January, February, and March 1974 were mapped for the first time by the Nimbus Electrically Scanning Microwave Radiometer (ESMR). Day and nighttime ESMR (19.35 GHz) coverage was analyzed for the low gradient, flooded Darling River system in New South Wales. Apparent movement of surface water as indicated by low brightness temperatures (less than 250 K, day and less than 240 K, night) was easily followed around the curved runoff basin along the northern shoreline of the flooded Darling River during this 3-month period. This pattern was in good agreement with flood crest data at selected river height gage stations, even under cloudy conditions. (Sims-ISWS)
W80-03474

A DISTANT READING RAINGAUGE,
Meteorological Office, Poona (India). Instruments Div.
N. V. Iyer.
Mausam, Vol 30, No 1, p 55-58, January 1979. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Remote sensing, *Rain gages, *Rainfall, Instrumentation, Flood forecasting, Flood control, Electronic equipment, Rainfall intensity, *Rainfall counter, *Instruments, Field testing, Hydrometeorological stations, Flood warning, Sensor, Electronic counter, Rainfall rate.

A remote indicating rainfall counter was designed, constructed, and field tested in the Instruments Division of the Pune Meteorological Office. The sensor used was a conventional tipping bucket rain gage connected to a counter housed inside the observatory office. The instrument can be useful in flood forecasting offices, hydrometeorological stations, and airport meteorological offices. The total

rainfall can be read off easily on the counter and the rate of rainfall determined by using a stopwatch during heavy periods of rain. A magnet attached to the tipping bucket moves past a reed switch to make an electrical contact for each tilt of the bucket. The contacts are conveyed by cable to an electronic counter made up of integrated circuits. Light-emitting diodes display the rainfall registered by the counter. The performance of the instrument was good when some of its limiting factors--such as a 1-mm least count and time lost during tipping the bucket plus friction--were taken into consideration. (Roberts-ISWS)
W80-03476

TREE RINGS AS INDICATORS OF HYDROLOGIC CHANGE IN THE GREAT DISMAL SWAMP, VIRGINIA AND NORTH CAROLINA,
Geological Survey, Reston, VA. Water Resources Div.
R. L. Phipps, D. L. Ireley, and C. P. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 385, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-136, 1979. 26 p, 5 Fig, 5 Tab, 17 Ref.

Descriptors: *Dendrochronology, *Hydrology, *Variability, *Swamps, Virginia, North Carolina, Model studies, Analytical techniques, Data collections, Loblolly pine trees, Sampling, Drainage, Climatic data, Regression analysis, Documentation, Precipitation(Atmospheric), Temperature, Water levels, Sites, *Great Dismal Swamp(Va-NC), Preditching, Postditching, Tree rings, Hydrologic change indicators.

Analysis of tree rings of large, canopy loblolly pines (Pinus taeda L.) growing near a drainage ditch in the Great Dismal Swamp have indicated that the tree rings are datable and hydrologically (climatically) sensitive. Climatic and prior growth factors in regression explained 87 and 71 percent of the variance of the preditching and postditching earlywood widths, respectively, and 82 and 70 percent of the latewood widths for the same time periods. Early summer precipitation was significantly, and positively correlated with preditching latewood growth. When preditching and postditching records were merged into a single record, regression analysis explained less growth variation than when the two time periods were considered individually, implying a change in growth response following ditching. Prior to ditching, growth was most limited by dry summers which followed dry summers. After ditching, growth was less strongly linked with precipitation and more strongly linked with temperature. Regression results are compatible with the contention that growing season water levels in the proximity of the collection site have been lower since ditching. (Kosco-USGS)
W80-03490

SOME IMPLICATIONS OF REMOTE SENSING TECHNOLOGY IN INSECT CONTROL PROGRAMS INCLUDING MOSQUITOES,
National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.
C. M. Barnes, and W. C. Cibula.
Mosquito News, Vol 39, No 2, p 271-282, June, 1979. 8 Fig, 16 Ref.

Descriptors: *Wetlands, *Remote sensing, *Vegetation, *Classification, Terrain analysis, Aerial photography, Photogrammetry, Research and development, Public health, Insects, Aquatic insects, Habitat.

Preliminary investigative work is described concerning the application of remote sensing technology to the classification of wetland vegetation and terrain which have implied public health and insect control significance. Initial activity concerned definition of mosquito breeding habitat using multibrand aerial photography, and multispectral sensing from aircraft. Photography is the least expensive remote sensing system yet both methods do an excellent job of defining environment and vegetative habitat. It appears feasible to utilize LANDSAT satellite imagery to classify into broad ecotypes the vegetation sometimes associated with insect development. Research has been limited to one mosquito species, but it seems likely that other species may be studied using similar techniques. (Howard-Mass)
W80-03514

MOVEMENT OF SUSPENDED PARTICLES AND SOLUTE CONCENTRATIONS WITH INFLOW AND TIDAL ACTION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2L.
W80-03564

7C. Evaluation, Processing and Publication

DELINEATION OF BURIED RIVER VALLEY AQUIFERS IN DISSECTED TILL PLAINS,
Missouri Univ. Columbia. Dept. of Geology.
J. M. Sharp, Jr., M. D. Hall, M. Bahorich, and C. Keefe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143621, Price codes: A04 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri Completion Report. November 1979, 51 p, 29 Fig, 24 Ref, 2 Append, OWRT A-112-MO (1), 14-34-001-9027.

Descriptors: *Subsurface mapping, *Bedrock, *Aquifers, Valleys, Glacial drift, Till, Geomorphology, Missouri, Iowa, *Buried River Valley aquifers, Gravity profile.

Several methods of gravity geophysics, in conjunction with drift thickness and bedrock topography maps, were used to map the location of buried river valleys in northwestern Missouri. Drift thickness varies from zero to over 100 metres within the selected study area. The buried valleys are often filled with thick sequences of glacial-fluvial deposits which can serve as important aquifers. Over 900 gravimeter readings established a grid network over the study area. Two methods were used to calculate the regional Bouguer free-air anomaly-poly-nomial trend surfaces of reduced gravity readings and trend surfaces defined solely by the well data. The fifth-order polynomial trend surface closely matched basement rock topography. This trend surface, along with the gravity residual and drift thickness maps, can then be used to delineate these valleys with fair accuracy. Gravity profiles were run normal to several suspected buried valleys. The gravity residual profiles showed a strong correlation to bedrock topography, where known, and to several theoretical models. Gravity profiling can be used to delineate the deepest portion of these valleys. In all cases, an adequate density contrast was observed between the drift and the bedrock. Several promising branch aquifers, previously unreported, are indicated.
W80-03302

USE OF SYNOGRAPHIC TECHNIQUES IN RESEARCH AND DISSEMINATION OF HYDROLOGICAL INFORMATION,
Texas Univ. at Houston. School of Public Health.
I. Cech, E. M. Davis, E. A. Gonzales, and D. Brooks.
Water Resources Bulletin, Vol 15, No 6, p 1691-1706, December 1979. 9 Fig, 11 Ref.

Descriptors: *Mapping, *Data processing, *Analytical techniques, *Urban runoff, *Water quality, Floods, Water pollution, Pollutants, Nutrients, Nitrogen, Nitrates, Phosphorus, Sodium, Chlorophyll, Bacteria, Groundwater, Estuaries, Water supply, *Houston(TX), Synographic mapping.

Application of synographic techniques to four separate nonrelated research tasks demonstrated the usefulness of such an approach in interpreting and communicating hydrologic survey data especially when large geographic areas are involved. Nutrient exchange and biotic indicators in coastal estuaries were analyzed to determine residence times in different seasons of the year. Man-induced changes in urban runoff patterns were shown to increase the probability of flooding with different recurrences of storm events. Nitrate and indicator bacteria in private wells were analyzed on a county-wide basis to determine the sources and extent of natural occurrence vs. contamination origins. Water wells and the surface supply of metropolitan Houston were analyzed for sodium content to assist citizens and physicians with data that are needed for derivation of sodium-restricted therapeutic diets. (Sims-ISWS)
W80-03360

GEOTHERMAL WELL DRILLING ESTIMATES BASED ON PAST WELL COSTS,
Department of Energy, Idaho Falls, ID. Idaho Operations Office.
For primary bibliographic entry see Field 6B.
W80-03427

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN CARSON COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 242, November 1979. 69 p, 18 Tab, 75 Ref, 24 Map.

Descriptors: *Groundwater resources, *Texas, *Aquifers, *Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping, Projections, Saturated flow, *Carson County(TX), *Ogallala aquifer(TX), Pumping rates, Pumping lifts, Well yields.

This is one of numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contains maps, charts, and tabulations that reflect estimates of the volume of water in storage in the Ogallala aquifer in Carson County and the projected depletion of this water supply by decade periods through the year 2020. The report also contains estimates of pumpage, pumping lifts, and other data related to current and future water use in the county. However, the report does not attempt to project that portion of the volume of water in underground storage that may be ultimately recoverable. The Ogallala aquifer in Carson County contained approximately 9.6 million acre-feet of water in 1974. Historical pumpage has exceeded 150,000 acre-feet annually, which is approximately six times the rate of natural recharge to the aquifer in the county. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. There is a very uneven distribution of groundwater in the county. Some areas have ample groundwater resources to support current usage through the year 2020; whereas, in other areas of the county, groundwater is currently in short supply. To obtain maximum benefits from the remaining groundwater resources, Carson County water users should implement all possible conservation measures so that the remaining groundwater supply is used in the most prudent manner possible and with the least amount of waste. (Humphreys-ISWS)
W80-03451

PROXIMITY OF PIPELINES AND STORAGE FACILITIES FOR GAS AND OIL TO MAJOR AQUIFERS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, J. W. Bingham, and E. H. Handman.
USGS 1200 S. Eads St. Arlington VA printed copy .75, Geological Survey Miscellaneous Field Studies Map MF-981-H, 1979. 1 Sheet, 1 Ref.

Descriptors: *Maps, *Pipelines, *Storage tanks, *Connecticut, *Water pollution sources, Oil, Gasoline, Aquifers.

A map of Connecticut, scale 1:125,000, shows locations of oil and gas pipelines and storage facilities

for fuel oil, gasoline, kerosene, diesel, and aviation fuels in relation to major aquifers. Inset map shows distribution of gasoline and diesel-fuel dealers by town. (Kosco-USGS)
W80-03479

PROXIMITY OF AGRICULTURAL AREAS TO MAJOR AQUIFERS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. W. Bingham, and A. R. Todd.
USGS 1200 S. Eads St. Arlington, VA price $0.75, Geological Survey Miscellaneous Field Studies Map MF-981-F, 1979. 1 Sheet, 2 Ref.

Descriptors: *Maps, *Water pollution sources, *Farm wastes, *Connecticut, *Aquifers, Crops, Livestock, Fertilizers, Pesticides, Waste disposal, Manure storage.

A map of Connecticut, scale 1:125,000, shows locations of agricultural land, manure storage areas, and dairy farm waste lagoons, and their relation to favorable aquifers. The map also delineates distribution of crops, livestock, fertilizer use, and pesticide use by county. (Kosco-USGS)
W80-03480

MAP SHOWING GROUND-WATER CONDITIONS IN THE BODAWAY MESA AREA, COCONINO COUNTY, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
C. D. Farrar.
Geological Survey open-file report 79-1488 (WRI), September 1979. 1 Sheet, 8 Ref.

Descriptors: *Groundwater resources, *Maps, *Aquifers, Water table, *Water quality, Hydrogeology, Indian reservations, Arizona, *Bodaway Mesa area(Ariz), Coconino County(Ariz), Navajo Indian Reservation(Ariz).

The Bodaway Mesa area includes about 800 square miles in north-central Arizona, and most of the area is in the Navajo Indian Reservation. Groundwater development has been slight; in 1977 the estimated ground-water withdrawal was less than 5 acre-feet. The Chinle Formation is the principal aquifer tapped by wells, and in places the Moenkopi Formation and the Redwall and Muav Limestones yield water to wells and springs. Water levels in the Chinle Formation are 15 to 200 feet below the land surface. The water from one well completed in the Petrified Forest Member of the Chinle Formation contained 1,210 milligrams per liter of dissolved solids; the dissolved-solids concentrations from two wells in the Shinarump Member of the Chinle were 1,000 and 1,110 milligrams per liter. Three wells penetrate the Moenkopi Formation, but only one yields water. One well obtains its water from the Redwall Limestone, and the water level is 2,200 feet below the land surface. About 60 cubic feet per second of water is discharged by springs that issue from the Redwall and Muav Limestones along the east wall of the canyon of the Little Colorado River. Information on the map includes depth to water, altitude of the water level, specific conductance, and fluoride concentrations. Scale 1:125,000. (Kosco-USGS)
W80-03481

HYDROLOGIC RECORDS, VERNA WELL-FIELD AREA, CITY OF SARASOTA, FLORIDA, 1962-76--A DATA REPORT,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Sutcliffe, Jr., and A. Buono.
Available from OFSS, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225, Price codes: $18.50 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1259, 1979. 141 p, 11 Fig, 13 Tab, 4 Ref.

Descriptors: *Hydrologic data, *Water wells, *Florida, *Groundwater, *Water supply, Aquifer characteristics, Drillers logs, Water level fluctuations, Pumping, Test wells, Chemical analysis, Specific capacity, Verna-well field area(Fla), Sarasota(Fla).

A short history of the development and operation of the Verna well field in Florida is presented. Also included are geological, drillers' and selected geophysical logs of test and production wells; chemical analyses; specific capacity tests; pumpage; physical dimensions of wells; and source for other data available as indicated. (Kosco-USGS)
W80-03485

CHARACTERISTICS OF FOUR URBANIZED BASINS IN SOUTH FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. A. Miller.
Geological Survey open-file report 79-694, May 1979. 45 p, 17 Fig, 17 Tab, 9 Ref.

Descriptors: *Watersheds(Basins), *Urban hydrology, *Urban runoff, *Hydrologic data, *Florida, Model studies, Rainfall-runoff relationships, Storm runoff, Data collections, *South Florida.

Physical characteristics of four urbanized basins in south Florida are presented. Land use of the four basins are low-density residential, highway, commercial, and high-density residential. Maps of each basin include a photomosaic, a sewerage map, a drainage map, and an impervious-area map. Tabular data include pervious and impervious areas; sewer data, such as pipe diameter, length, and slope; and inlet elevations. General descriptions of the soil cover and type, vegetation, streets, gutters and curbs are also provided. (Kosco-USGS)
W80-03486

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1978.
Geological Survey, Boston, MA. Water Resources Div.
Geological Survey Water-Data Report NH-VT-78-1, October 1979, 199 p, 3 Fig, Append.

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface waters, *Groundwater, Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1978 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 83 gaging stations, stage records for 4 lakes, monthend contents for 25 lakes and reservoirs, water-quality data for 7 gaging stations, and water levels for 42 observation wells. Also included are data for 37 crest-stage partial-record stations and 6 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in New Hampshire and Vermont. (Kosco-USGS)
W80-03491

WATER RESOURCES DATA FOR MAINE, WATER YEAR 1978.
Geological Survey, Augusta, ME. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122310, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ME-78-1, September 1979. 230 p, 3 Fig, 1 Tab.

Descriptors: *Maine, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Maine consist of records of stage, discharge, and water quality of streams, stage and contents of lakes and reservoirs, and water-levels and water quality of wells. This report contains discharge records for 68 gaging stations, stage only for 2 gaging stations, contents for 17 lakes and reservoirs, water quality for 13 gaging stations and 22 wells, and water levels for 22 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (Kosco-USGS)
W80-03492

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1978.
Geological Survey, Doraville, GA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114622, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report GA-78-1, September 1979. 384 p, 5 Fig.

Descriptors: *Georgia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Georgia consist of records of stage, discharge, and water quality of streams, and stage and contents of lakes and reservoirs. This report contains discharge records for 101 gaging stations, stage for 10 gaging stations, stage and contents for 16 lakes and reservoirs, water quality for 18 continuous stations and 114 periodic stations, and peak stage and discharge only for 96 crest-stage partial-record stations and 15 miscellaneous sites. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Georgia. (Kosco-USGS)
W80-03493

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1979,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. D. Carlson, and S. L. Green.
Available from: OFSS, USGS Bx 25425, Fed. Ctr. Denver, CO printed copy $15.50 microfiche $3.50, Geological Survey open-file report 79-1278, 1979. 115 p, 11 Fig, 5 Tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Wyoming, Hydrologic data, Water supply, Streamflow, Flow rates, Sediment transport, Reservoirs, Observation wells, Projects, Publications, Annual, Reviews.

This report contains lists of surface-water stations, ground-water stations, water-quality stations, sediment stations, and peak-flow partial-record stations in Wyoming. The locations of the data-collection sites are shown on maps. Water-resources projects in Wyoming are also described, including many that are related to development of energy resources. The general locations of the projects are shown on maps. The U.S. Geological Survey is striving to coordinate its water-resources investigations with those of other agencies. This report serves as an annual progress report to cooperators and the public. (Kosco-USGS)
W80-03495

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1978--VOLUME 1. DELAWARE RIVER BASIN.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118862,

Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PA-78-1, September 1979. 374 p, 12 Fig, 4 Tab.

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River basin(PA).

Water resources data for the 1978 water year for Pennsylvania consist of records of discharge, and water quality of streams, contents of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 83 gaging stations, contents at 10 lakes and reservoirs, water quality at 59 gaging stations and water levels at 16 observation wells. Also included are data for 43 crest-stage, 35 low-flow, and 44 water-quality partial record stations. Locations of these sites are shown on figures 4 and 5. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellanous measurements and analyses. These data together with the data in Volume 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (Kosco-USGS)
W80-03496

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1978--VOLUME 2. SUSQUEHANNA AND POTOMAC RIVER BASINS.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118870, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PA-78-2, June 1979. 411 p, 7 Fig, 1 Tab.

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Susquehanna River basins(PA), *Potomac River basins(PA).

Water resources data for 1978 water year for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. This volume contains records for water discharge at 99 stations, contents at 10 lakes and reservoirs, water quality at 95 gaging stations, and water levels at 29 observation wells. Also included are data for 23 crest-stage, 47 low-flow and 46 water-quality partial-record stations. Locations of these sites are shown on figures 3 and 4. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (Kosco-USGS)
W80-03497

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1978--VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASINS.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118888, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PA-78-3, July 1979. 310 p, 5 Fig.

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Ohio River basin(PA), *St. Lawrence River basin(PA).

Water resources data for the 1978 water year for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels and water quality of ground-water wells. This volume contains records for water discharge at 96 gaging stations, contents at 22 lakes and reservoirs, water quality at 69 gaging stations and 14 wells, and water levels at 25 observation wells. Also included are data for 12 crest-stage, 28 low-flow, and 26 water-quality partial-record stations. Locations of these sites are shown on figures 4 and 5. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (Kosco-USGS)
W80-03498

8. ENGINEERING WORKS

8A. Structures

WELL DRILLING FOR +250F WATER,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
G. G. Culver.
Geo-Heat Utilization Center Quarterly Bulletin, Vol 3, No 1, p 8-10, August, 1977. 1 Fig.

Descriptors: *Geothermal studies, *Drilling, *Shallow wells, *Heat exchangers, Depth, Heating, Costs, Thermal water.

In most areas, cable tool or rotary drilling rigs that are used for water wells can also be used for geothermal wells. The maximum depth and diameter of the well depends on the size of the rig and the type of formations encountered. Cable tool rigs are generally limited to 3,000 ft. while rotary rigs can go as deep as 3,500 ft. with excellent drilling conditions. Downhole heat exchangers can be installed in a hot water well to meet the heating needs of one or more homes. City water is circulated in the heating loop making a completely closed system. Since no geothermal water is removed from the well, there are no disposal problems. A 500 foot deep, 16 inch diameter well can produce about 2.8 million BTU's per hour without lowering the well temperature. That is enough heat for about 30 average homes. The cost for this well would be about $25,000 not including the cost of the piping system to distribute the hot water. (Purdin-NWWA)
W80-03428

APPLICATION OF OPERATIONS RESEARCH TECHNIQUES FOR A PROBLEM IN WATER RESOURCES MANAGEMENT: ECONOMIC APPRAISAL OF CHANGES IN WATER USE INDUCED BY INVESTMENTS INTO NAVIGABLE RIVERS AND CANALS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Operations Research.
For primary bibliographic entry see Field 6A.
W80-03501

VORTEX PROBLEM AT INTAKE, LOWER ST. ANTHONY FALLS LOCK AND DAM, MISSISSIPPI RIVER, MINNEAPOLIS, MINNESOTA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. H. Ables, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A072 918, Price codes: A04 in paper copy, A01 in microfiche. Technical Report HL-79-9, May 1979. 69 p, 5 Tab, 19 Photos, 18 Pl.

Descriptors: *Vortices, *Intakes, *Hydraulic models, *Locks, Dams, Design criteria, *St. Anthony Falls Lock & Dam(Mississippi River), Minnesota, Minneapolis(Minn).

A 1:25-scale model was used to develop the most feasible and permanent solution to a vortex problem at the Lower St. Anthony Falls Lock Intake on the Mississippi River at Minneapolis, Minnesota. On 10 March 1974, a lock employee in a small boat was accidentally drawn into the vortex and killed. Since then a delayed valve-operating schedule has been used, with a fill time in excess of 14 min, about twice the design fill time; and although the vortex condition is reduced, conditions are not considered satisfactory or safe. Recommended design (type 5) moved the intakes from the top of the upper gate sill and positioned a new intake in the upstream face of the sill, lowered the approach geometry in the approach to the intake ports, lengthened the bull-nose pier between the existing lock and a possible future auxiliary lock and replaced the 7.5-ft-radius nose of the pier with an elliptical nose, added a vortex suppressor across the 56-ft-wide approach, and modified the culvert tainter control valve schedule from 2.07 min to 4.14 and 6.21 min. These modifications to the intake, geometry of the structure, and approach, together with the slower valve schedules, permitted vortex-free lock operation. (WES)
W80-03557

STABILITY AND STRESS ANALYSES OF BRANDON ROAD DAM, ILLINOIS WATERWAY,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. E. Pace, and R. L. Campbell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A064 811, Price codes: A09 in paper copy, A01 in microfiche. Miscellaneous Paper C-78-18, December 1978. 195 p, 9 Fig, 10 Tab, 8 Ref, 2 Append.

Descriptors: *Dams, *Stability, *Stress analysis, Finite element analysis, Design criteria, *Illinois waterway, *Brandon Road Dam.

The tainter-gate, sluice-gate, ice-chute, and head-gate monoliths of Brandon Road Dam were analyzed to determine if they meet present-day stability requirements. Stability analyses for the monoliths were performed for these case loadings: (1) normal operation, (2) normal operation plus ice, (3) normal operation plus earthquake, and (4) flood condition. In the analyses of the tainter-gate, sluice-gate, and ice-chute monoliths, the total monolith for each was analyzed and determined to be adequate in stability. However, due to overstress between the main body and the downstream apron of the structures, the aprons of each were considered ineffective and were eliminated from the analyses. Shear stresses in the keys that connect the pier and spillway sections of the tainter-gate monoliths were calculated and found to be less than the allowable 1.1 sq. rt. f'c. Therefore, the pier and spillway are considered to act monolithically. In the stability analyses of the tainter-gate, sluice-gate, ice-chute, and head-gate monoliths, results showed the monoliths to be inadequate against overturning stability for all case loadings. The head-gate monoliths were also inadequate for resistance against sliding. To correct these deficiencies, prestressing was recommended and the details are presented for each of the monoliths. (WES)
W80-03558

FILLING AND EMPTYING SYSTEM, NEW SHIP LOCK, MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. H. Ables, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 074, Price codes: A07 in paper copy, A01 in microfiche. Technical Report H-78-16, September 1978. 100 p, 4 Pho, 43 Pl, 15 Tab, 7 Ref.

Descriptors: *Locks, *Hydraulic models, *Design criteria, Barges, Barge tow tests, *New Ship Lock(La), *Mississippi River-Gulf Outlet(La).

Test results of the hydraulic system for the proposed New Ship lock in a 1:25-scale hydraulic

model are presented. The original intake and outlet designs which must perform as both intakes and outlets were investigated and found to be satisfactory. Tests of 20 sidewall port manifold arrangements resulted in the recommendation of the type 15 sidewall port manifold arrangement. This arrangement consisted of 20 original design ports (throats 5 by 3.25 ft), spaced 38 ft on centers in each 18.5 by 18.5-ft wall culvert with the ports staggered in opposite walls. For the lock to perform satisfactorily for deep-draft ships, the chamber floor must be constructed at a lower invert elevation than for barge tows. Sufficient ship model input data were presented to permit necessary economic analysis to determine the feasibility of the type 15 (recommended) design manifold port system as developed with some lowering of the chamber floor and manifolds between the miter gates. The type 15 (recommended) design sidewall port system as developed is considered optimum for barge tows and satisfactory for ships with proper clearance provided between the bottom of the ships and floor of the lock chamber. (WES)
W80-03561

OUTLET STRUCTURE FOR MERAMEC LAKE, MERAMEC RIVER, MISSOURI; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
B. P. Fletcher.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 109, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-78-15, October 1978. 59 p, 12 Pho, 30 Pl, 4 Tab.

Descriptors: *Outlet works, *Intake structures, *Hydraulic models, Lakes, Missouri, Design criteria, *Meramec Lake(Mo).

Model investigation of the outlet works for Meramec Lake was concerned with verification and improvement of the hydraulic performance of the intake structure, transition, conduit, stilling basin, and exit channel. Hydraulic performance of the original and revised outlet works with 22- and 14-ft-wide horseshoe-shaped conduits, respectively, was investigated by means of 1:40- and 1:25.5-scale models. Flow distribution into the stilling basin was improved by providing a 38-ft-long horizontal apron immediately downstream of the 14-ft-wide conduit and placing the sidewalls 1 laterally in 16 longitudinally from the exit portal to the end sill. General discharge characteristics of the outlet works were defined as well as the minimum size and extent of stone protection required in the exit channel immediately downstream of the flared stilling basin. (WES)
W80-03563

OHIO RIVER BASIN STUDY--COMPREHENSIVE SURVEY: VOLUME XIII-APPENDIX L, NAVIGATION.
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 6B.
W80-03570

FLOATING-TYPE ANTI-OIL, ANTI-IMPACT AND ANTI-WAVE BARRIER,
Mitsubishi Jukogyo Kabushiki Kaisha, Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5G.
W80-03593

8B. Hydraulics

PRESENTATION OF LONGITUDINAL DISPERSION DATA,
Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 2E.
W80-03379

SIDE-CHANNEL SPILLWAY AND OUTLET WORKS FOR SAN ANTONIO DAM; HYDRAULIC MODEL INVESTIGATION,
Army Engineer District, Los Angeles, CA.
D. A. Barela.
Report No 2-106, October 1978. 56 p, 36 Photos, 12 Pl, 1 Tab, 1 Append.

Descriptors: *Spillways, *Outlet works, *Hydraulic models, Design criteria, Engineering structures, *San Antonio Dam, *Side-channel spillways.

Model studies of proposed uncontrolled side-channel spillway and outlet works for San Antonio Dam were conducted to develop, by means of 1:36- and 1:48-scale models of the spillway and a 1:20-scale model of the outlet works, satisfactory and economical designs for these elements. Particular attention was given to flow characteristics in the side channel, spillway chute, and flip bucket for side-channel spillway and to performance of the intake structure, outlet conduit, and diversion structure for the outlet works. Although the spillway crest functioned satisfactorily as originally designed, excessive ride-up and turbulence in the side channel during maximum design flow of 54,000 cfs indicated need for improved performance of the channel. Addition of baffle blocks on side-channel invert provided adequate control of flow and reduced excessive ride-up occurring in the channel. Flow in the spillway chute was more stable and less turbulent. Tests of the intake structure and outlet circular conduit disclosed flow conditions were acceptable. Results revealed for a discharge of 1,000 cfs, performance of the diversion structure was satisfactory. Measured discharge to each part of the spreading grounds agreed with design assumptions. As flow in the outlet conduit was increased, however, disturbance at entrance to chamber became more pronounced. (WES)
W80-03394

SOUTH JETTY STABILITY STUDY, MASONBORO INLET, NORTH CAROLINA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. D. Carver, and D. G. Markle.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 132, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper H-78-12, October 1978. 41 p, 22 Photos, 6 Pl, 7 Ref.

Descriptors: *Jetties, *Stability, Model studies, Design criteria, Hydraulic models, *Coastal structures, *Breakwaters, North Carolina, *Armor units(Hydraulics), *Masonboro Inlet(NC).

Hydraulic model flume tests were conducted to investigate the stability response of a jetty cross section proposed for the South Jetty, Masonboro Inlet, North Carolina. The original design (Plan 1) was not stable, and three additional designs were tested in an effort to find a satisfactory solution. All designs tested consist of one layer of armor stone subjected to breaking wave conditions. None of the designs were completely stable for all the designated storm conditions, and sufficient funds were not available to further the investigation. Based on the tests conducted, results show that all the designs were stable for storm conditions at the 8.5 ft mllw swl, but none of the designs were stable for storm conditions at the 12.5 ft mllw swl. Thus, whether the designs tested meet the no-damage criteria depends upon the selection of the design storm condition. (WES)
W80-03397

THE EFFECT OF SALINITY ON GEOTHERMAL WELL PERFORMANCE,
California Univ., Livermore. Lawrence Livermore Lab.
J. Z. Grens.
Available from the National Technical Information Service, Springfield, VA 22161 as UCID-16791, Price codes: A02 in paper copy, A01 in microfiche. Report UCID-16791, May 14, 1975. 14 p, 5 Fig, 2 Tab, 13 Ref.

Descriptors: *Geothermal studies, *Salinity, *Wells, *Performance, Productivity, Energy loss, Brines, Density, Viscosity, Vapor pressure, Thermal capacity, Enthalpy, Entropy, Flow resistance.

As the salinity of geothermal brines increases, changes occur in physical and thermodynamic properties which strongly affect the energy content and availability of the brines and the performance of the producing wells. In a typical well flowing at 500 lb/sq.ft./sec. pressure losses are distributed roughly 1/4 to formation breakdown, 1/4 to friction, and 1/2 to hydrostatic loss. The higher density and lower vapor pressure which accompany increasing salinity both tend to add to the hydrostatic gradient in the flowing well. Two phase flow effects in the well bore add a few percent to the hydrostatic gradient. Energy yield is reduced due to low enthalpy of brines and decreased well flow. Each 1% dissolved solids reduces available energy by 0.8 to 0.9% compared to distilled water at the same temperature and pressure. The distribution of pressure losses will vary with formation properties, in situ conditions and well parameters. (Purdin-NWWA)
W80-03430

HEAD-LOSS MEASUREMENTS ON HYDRO-ELECTRIC CONDUITS,
Hydro-Electric Commission of Tasmania, Hobart (Australia).
T. M. Brett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15109, p 173-190, January 1980. 6 Fig, 8 Tab, 11 Ref, 2 Append.

Descriptors: *Tunnel linings, *Canal design, *Australia, Hydroelectric plants, *Head loss, Penstocks, *Pipe flow, Pipelines, Hydraulics, Friction, Algae, Aquatic plants, *Hydroelectric conduits, Friction coefficient(Hydraulic), Power generation, Power.

Prototype head-loss measurements on tunnels and other water conduits were reported. The measurements were done on water-power conduits of the Hydro-Electric Commission of Tasmania, Australia. Friction factors are given for an unlined tunnel, a mechanically bored partly lined tunnel, and a fully lined tunnel. Steel and woodstave friction factors were included together with factors for a concrete-lined trapezoidal canal. The effect of slime growth on head losses was discussed. (Lee-ISWS)
W80-03453

FLOW PAST FENCE IN TURBULENT BOUNDARY LAYER,
Roorkee Univ. (India). Dept. of Civil Engineering.
P. K. Pande, R. Prakash, and M. L. Agarwal.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15151, p 191-207, January 1980. 14 Fig, 1 Tab, 24 Ref, 2 Append.

Descriptors: *Turbulent boundary layers, *Flow around objects, *Flow separation, *Model studies, Mathematical models, Hydraulic models, Boundary layers, Flow rates, Turbulent flow, Friction, Flow friction, Fluid friction, Bubbles, Hydraulics, Fences.

The flow past a fence submerged in a turbulent boundary layer was studied experimentally. The characteristics of the flow both upstream and downstream of the fence were presented. The variation of boundary layer parameters, velocities, turbulence intensities, and skin friction were reported. The sizes of the upstream and downstream separation bubbles were also correlated with relevant parameters. The results were also compared with the numerical solution of momentum and energy integral equations for the approach boundary layer. (Sims-ISWS)
W80-03454

FEASIBILITY STUDY OF A NUMERICAL TOW MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. D. Ankeny, C. J. Huval, and L. L. Daggett.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 727, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper H-78-11, September 1978. 52

p, 11 Tab, 12 Ref, 2 Append.

Descriptors: *Barges, *Mathematical models, *Feasibility, Transportation, Locks, Dams, Barge tow, *Towboats, Tows and towing, Ship maneuverability.

Explores the feasibility of developing a numerical hydrodynamic model of a typical push towboat-barge combination for use in engineering planning and design studies. Such a model might be used to simulate tow movements in restricted waterways in critical river reaches such as bends, bridges, and near navigation locks and dams to determine the adequacy and/or economic efficiency of channel designs. No information was available at the beginning of this study on numerical models of tow hydrodynamics or on towing tank or prototype tests of the maneuverability of tows. During the study several numerical models did become available, and this work is described. Since no information was available for the development or testing of a numerical tow maneuvering model, a series of measurements were made of radio-controlled scale model tows used in physical model studies involved in standard ship hydrodynamic maneuvers. Data from these measurements and computations were used to determine estimates of hydrodynamic coefficients of a linear model of ship maneuverability. Findings show tow maneuvers can be predicted by a numerical model of tow maneuverability; however, additional measurements of tow response characteristics are required before a model useful in engineering studies can be developed. (WES)
W80-03562

8C. Hydraulic Machinery

SHAFT TORSIONAL OSCILLATIONS OF HYDROGENERATORS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
L. E. Eilts, and E. Campbell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102155, Price codes: A03 in paper copy, A01 in microfiche. Report No REC-ERC-79-6, August 1979. 30 p, 16 Fig, 1 Tab, 2 Append.

Descriptors: *Hydroelectric plants, *Generators, *Electric generators, *Strain gages, Analog computers, Elasticity(Mechanical), Dynamics, Instrumentation, Resonance, Prototype tests, Model studies, Torsion, Turbines, Motor generators, Oscillation.

Shaft torsional oscillations of electrical generators are analyzed, modelled, and instrumented to study the torsional behavior of hydrogenerators and the effect of high-initial-response static excitation systems on damping of torsional oscillations. Block diagram and analog computer models were developed from mathematical equations modelling shaft torsional phenomena. Data calculated from several Bureau of Reclamation hydrogenerators are included. A single shaft torsional oscillation mode generally characterizes hydrogenerators. This oscillation mode is adequately damped due to viscous waterwheel damping. Results of tests at the Grand Coulee Powerplant show that hydrogenerator excitation systems have negligible effect on shaft torsional oscillations due to the large inertia of hydrogenerator rotors. An instrumentation system was developed for prototype field measurements. The system uses shaft-mounted strain gages to provide a torsional signal. The system was used to obtain shaft torsional oscillations data from three units and these data are presented along with the design and circuit configuration of the system. The information given is specifically applicable to hydrogenerators but is equally applicable to other types of generators. (Seigler-IPA)
W80-03315

ELECTRONIC FILTER LEVEL OFFSET (EL-FLO) PLUS RESET EQUIPMENT FOR AUTOMATIC DOWNSTREAM CONTROL OF CANALS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. P. Buyalski, and E. A. Serfozo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104003, Price codes: A07 in paper copy, A01 in microfiche. Report No REC-ERC-79-3, June 1979. 151 p, 53 Fig, 20 Tab, 7 Ref, 6 Append.

Descriptors: *Canals, *Automatic control, *Irrigation canals, *Analog models, Analog computers, Mathematical models, Laboratory tests, Model studies, Water management(Applied), Water levels, Flow, Hydraulics, California, Arizona, Filters.

To upgrade the operation and efficiency of canal systems an automatic integrated circuit system of downstream control of canal gates was developed. The control mechanism, an analog computer controlled electronic filter level offset (EL-FLO) plus RESET was mathematically modeled, designed, constructed, and tested. The control system can handle complex irrigation water delivery schedules while maintaining nearly constant water levels in a canal system. An electronic time delay replaces the cumbersome hydraulic filter to eliminate the inherent sustained water level oscillations for automatic flow regulation systems. The RESET controller eliminates the residual water offset associated with proportional control. Laboratory simulation tests were performed to confirm that the control system was designed and built as modeled and to test equipment performance at high temperatures and high humidity. Field tests of the control system conducted at the South Gila Canal in Arizona and the Corning Canal in California verified the accuracy of the systems' response characteristics. Following the positive testing results EL-FLO plus RESET specifications were written and 21 units were permanently installed in California on the Coring and Coalinga Canals. Extensive test result data are included. (Seigler-IPA)
W80-03387

TWENTY YEARS OF EXPERIENCE WITH WELL-WATER-SOURCE HEAT PUMPS AT BATTELLE'S COLUMBUS LABORATORIES,
Battelle Columbus Lab., OH.
R. D. Fischer, C. F. Holt, S. G. Talbert, and T. E. Maloy.
Paper presented at the 4th Annual Heat-Pump Technology Conference, Oklahoma State University, Stillwater, Oklahoma, April 9-10, 1979. 8 p, 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Heat pumps, *Ground water, Well spacing, Safe yield, Pumping, Cost comparisons, Operating costs, Heating, Cooling, Maintenance, Shallow wells, Scaling.

Two similar heat pumps, installed 20 years ago, are still providing primary comfort-conditioning needs of four laboratory and office buildings with a total floor area of approximately 320,000 sq. ft. These systems use as a heat source, ground water from five shallow wells in sand and gravel of the Olentangy River flood plain. The maximum safe yield of the well field is 1400 gpm. The cost of heating with four conventional fuels is compared with that for the ground water heat pump. The heat pump costs slightly less than coal and natural gas. The coefficient of performance of the heat pump system is 4.4 which means that 4.4 times as much energy is obtained from the system as is put into it. Monthly well-water consumption and electric power consumption of the compressor motors are given for 13 years. Yearly maintenance procedures, operational problems that were solved, and future plans are discussed. (Purdin-NWWA)
W80-03425

SELECTION AND DESIGN OF INJECTOR PUMP SYSTEMS,
J. Rossetti.
Canadian Water Well, Vol 5, No 3, p 28, 30, August, 1979. 4 Fig.

Descriptors: *Pumps, *Design criteria, Storage tanks, Pipes, Water wells, Deep-well pumping, Water delivery, Water utilization.

The design and selection of shallow (+25 ft.) and deep (+60 ft.) well injector pumps are discussed. Selection of the proper injector pump depends on: (1) inside diameter of well; (2) depth of well; (3) pumping water level; (4) capacity of well; (5) capacity and pressure requirements of the system. Selection would be made from pump performance tables. In some cases, where the inside diameter of a deep well is too small for a parallel pipe injector, an inner pipe injector can be used. Single stage shallow well injector pumps should be capable of pressures of 30 to 50 psi. For higher operating pressures, multi-stage shallow well injector pumps are available with discharge pressures up to 110 psi. Most deep and shallow well water systems use plastic pipe due to its low cost, reduced friction loss, and low installation cost. However, the grade of pipe must be strong enough to withstand the pressure. Pre-charged pressure tanks deliver more water between cycles but tankless water systems with constant pressure are growing in popularity. To protect the system from freezing, pipes must be buried deep enough and pumps should be heated. A good system will include a gate valve between the pump and tank and a priming tee. (Purdin-NWWA)
W80-03429

DOWNHOLE PUMPS FOR WATER SAMPLING IN SMALL-DIAMETER WELLS,
Geological Survey, NSTL Station, MS. Water Resources Div.
F. C. Koopman.
Available from OFSS, U.S Geological Survey, Box 25425, Federal Center, Denver, CO 80225, Price codes: $8.50 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1264, 1979. 61 p, 1 Fig, 5 Tab.

Descriptors: *Pumps, *Groundwater, *Sampling, *Water wells, *Methodology, Deep-well pumping, Specifications, Equipment, Design, Performance, *Small-diameter wells.

The relatively high cost and difficulty in locating a source of pumps for use in obtaining ground-water samples from small-diameter wells has demonstrated a need for this report. Criteria for selection of a pump and pumping equipment to meet specific requirements has been tabulated to assist field personnel in making a selection from commercial sources. (Kosco-USGS)
W80-03483

8D. Soil Mechanics

LABORATORY PROCEDURES FOR DETERMINING THE DISPERSIBILITY OF CLAYEY SOILS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. L. Kenney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 097, Price codes: A03 in paper copy, A01 in microfiche. Report No REC-ERC-79-10, September 1979. 24 p, 12 Fig, 4 Tab, 26 Ref, 1 Append.

Descriptors: *Clays, *Soil tests, *Dispersion, *Soil analysis, *Hydrometers, *Erosion rates, Chemical analysis, Laboratory tests, Cation adsorption, Cations, Soil texture, Soil aggregates, Soil types, Turbidity, Chemical analysis, Instrumentation.

Procedures for the following dispersive clays tests are described: the pinhole test, chemical analyses, double hydrometer test, and the crumb test. All four tests are used to measure the potential dispesibility or erodibility of clayey soils which are difficult to distinguish from nonerodible clays by conventional index tests. For the pinhole test five equal lifts of sample soil totaling 38 mm in height are molded and allowed to stabilize for 16 hours in a sealed cylinder. A truncated brass cone is pushed into the upstream end of the sample and a 1 mm-diameter hypodermic needle is pushed through the entire sample to produce the 'pinhole'. After adding screens and glass spheres, the sample is placed horizontally and distilled water under a 50 mm hydrostatic head is passed through the sample. Results from this flow are used along with electrical conductivity, turbidity, and pH to measure the

dispersibility of the sample. Chemical testing procedures are used to identify potentially dispersive clays by isolating and identifying soluble water cations and cations adhering to clay particle surfaces. The crumb test or aggregate coherence test involves the timed hydrating or crumbling of a 15 mm cube of soil in 250 ml of distilled water. For the double hydrometer test two identical 200 g samples are used. One sample is subjected to standard graduation analysis while the other is dried, rehydrated, deaired and then measured. (Seigler-IPA)
W80-03316

8I. Fisheries Engineering

INVESTIGATIONS INTO THE EFFECTS OF VOLUME OF WATER FLOW, QUALITY OF FEED AND TYPE OF FEEDING ON THE PRODUCTION OF THE AISCHGRUND COMMON CARP, CYPRINUS CARPIO, IN CIRCULAR CONCRETE PONDS UNDER HIGH STOCKING DENSITY RATES,
Lowveld Fisheries Research Station, Marble Hall (South Africa).
F. D. W. Brandt, and H. J. Schoonbee.
Water SA, Vol 5, No 4, p 171-177, October 1979. 2 Fig, 5 Tab, 14 Ref.

Descriptors: *Carp, *Proteins, *Fish diets, *Fish farming, *Fish populations, Fish harvest, Fish stocking, Fisheries, Flow, Concrete structures, Irrigation water, Water reuse, Density, Oxygenation, Ponds, Agriculture.

Changes in protein content of pelleted fish feed and changes in water flow were tested during the summers of 1974 through 1976 as means of increasing fish production and conserving water in the growth of fish at the Lowveld Fisheries Research Station at Marble Hall, South Africa. Due to the shortage of water in the area and its demand for irrigation, water is used first for fish production and then for irrigation. The fish used for the tests was the Aischgrund common carp, Cyprinus carpio, which was imported from Germany. The fish were grown in circular concrete ponds having a capacity of 16.1 cu m and in water transported by canal from the Loskop Dam Irrigation Scheme. To test protein content of feeds the ponds were stocked with 1000 carp fingerlings each for a density of 62/cu m of pond water. Types of feed tested were trout pellets with 42% protein and carp pellets with 25% protein. Some ponds were fed by hand and some were equipped with a demand feeder. Results show that the 42% protein pellet was superior to the 25% protein pellet for production of fish at high densities. Pond water flow effects on production were also tested by regulating flow by 1, 2, or 3 liters. Ponds were again stocked at 62/cu m density. Flow regulation results show that a slight increase in flow results in a major improvement in production capacity for the type of concrete pond and stocking density tested. (Seigler-IPA)
W80-03323

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

A TECHNOLOGY TRANSFER STUDY OF WATER RESOURCES: A SOUTH CAROLINA EXPERIENCE,
Clemson Univ., SC. Dept. of Political Science.
H. E. Albert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149966, Price codes: A05 in paper copy, A01 in microfiche. Prepared for the South Carolina Water Resources Commission, July 1979. 74 p, 14 Fig. OWRT T-0020 (7705)(1).

Descriptors: *South Carolina, *Technology, *Groundwater, *Information exchange, Publications, Data collections, Research and development, Organizations, Administration, Water conservation, Education, Training, Brochures, Technology transfer.

Technology-transfer techniques used by the South Carolina Water Resources Commission (SCWRC) are examined with emphasis on the transfer of groundwater technology. Two basic groups of SCWRC information users are decision makers such as government officials or private industry and doers such as consulting engineers and well drilling contractors. A one year project is described that was designed to: (1) discover the state-of-the-art in technology transfer, (2) conduct seminars and workshops to transfer technology to users, and (3) develop a mailing list of potential users and a newsletter to lead to the establishment of a clearinghouse for recently developed technology. Interviews were conducted with various researchers to determine what research was being done, who was sponsoring it, what technology they hoped to develop, and who the expected users were. Groundwater investigations in the Lowcountry and in Horry, Georgetown, and Marion Counties were used as technology transfer demonstration projects. An existing mailing list for the newsletter, Palmetto Waters was expanded but is still disorganized and needs further attention. It is concluded that the SCWRC does an outstanding job of research and technology transfer given the constraints of its budget. Copies of several information bulletins are included. (Seigler-IPA)
W80-03384

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 11
JUNE 1, 1980

W80-03601 -- W80-03900
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SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 13, NUMBER 11
JUNE 1, 1980

W80-03601 -- W80-03900

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

AN ANALYSIS OF THE IRREVERSIBLE THERMODYNAMICS MODEL FOR COUPLED HEAT AND MOISTURE TRANSPORT PHENOMENA IN UNSATURATED POROUS MEDIA,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
J. A. Havens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149321, Price codes: A06 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas Publication No 67, Project Completion Report, January, 1980. 122 p, 42 Fig, 4 Tab, 111 Ref, 1 Append. OWRT A-042-ARK(2).

Descriptors: *Mathematical models, *Thermodynamic behavior, *Heat transfer, *Water temperature, Thermodynamics, Moisture content, Transfer, Model studies, Water transfer, Volumetric analysis, Gravimetric analysis, Porous media, Saturation.

The coupled heat and moisture transfer equations of the Irreversible Thermodynamics (IT) theory, attributed to Cary and Taylor, were numerically interpreted to predict steady-state temperatures and moisture content profiles for a sealed unsaturated system. The system was a one-dimensional spherical unit of distilled water-unsaturated glass beads (210 to 298 microns) that was subjected to known heat flux rates. Model predictions were compared with measured moisture and temperature profiles from an experimental investigation. Model development is discussed including the thermodynamics of irreversible processes, transport equations, solution techniques, and measurement of transport coefficients. For the experimental investigation two concentric spheres were mounted on a support stand with a heater encased in the inner sphere. This entire system was enclosed in a constant temperature air bath. Thermocouples and a potentiometric recorder were used to monitor temperatures. Gravimetric analyses of samples extracted from three locations were used to measure moisture content. Eleven experimental runs were performed and analyzed and profiles of the results are given. Comparison of these data with model predictions show the validity of the IT approach. The moisture content gradient to heat flux coupling coefficient was small and a negligible heat flux was associated with the moisture content gradient. A brief historical and literature review is included. (Seigler-IPA)
W80-03639

STRUCTURAL CONTROLS OF HOT-SPRING SYSTEMS IN SOUTHWESTERN MONTANA,
Montana State Univ., Bozeman; and Geological Survey, Helena, MT. Water Resources Div.
R. A. Chadwick, and R. B. Leonard.
Available from: OFSS BX 25425, Fed. Ctr. Denver CO printed copy $3.50 microfiche $3.50. Geological Survey open-file report 79-1333, September 1979. 25 p, 4 Fig, 1 Tab, 53 Ref.

Descriptors: *Structural geology, *Hot springs, *Montana, *Geothermal studies, *Faults(Geologic), Thermal water, Thermal springs, Fractures(Geologic), Rocks, Conduits, Aquifers, Water temperature, *Southwest Montana.

Thermal waters that issue as hot (more than 38C) springs in southwestern Montana appear to circulate to depth along Cenozoic block faults, deep fractures penetrating the dominantly crystalline rock crust, or major structural lineaments. At individual hot springs, rising thermal waters are transmitted along conduits formed by the intersection of a major fault with other faults, fracture zones, anticlinal axes (which may be faulted or fractures), or sedimentary aquifers. Step faults and other intra-valley faults may influence circulation at some springs. At others, fracture zones alone may provide the necessary vertical permeability. Normal regional heat apparently is sufficient to maintain the hydrothermal systems without enhancement from cooling igneous bodies. The thermal gradient normally is higher in low thermal conductivity sediments of the block-fault valleys than the 30C per kilometer average for crystalline rock. To attain reservoir temperatures of 60 to 120C indicated by chemical geothermometers, waters would have to circulate to depths of about 2 to 4 kilometers in crystalline rock and about 1 to 2 kilometers in valley sediments. (Kosco-USGS)
W80-03760

2. WATER CYCLE

2A. General

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
For primary bibliographic entry see Field 5B.
W80-03609

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
For primary bibliographic entry see Field 7C.
W80-03613

OPTIMIZATION OF UNIT HYDROGRAPH DETERMINATION,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-03617

METHODS OF ESTIMATING SOME POSSIBLE INTERACTIONS OF AGRICULTURAL DEVELOPMENT AND WATER RESOURCES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
J. D. Fox, Jr., and J. D. LaPerriere.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152853, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-22-B, January 1980. 14 p, 16 Ref. OWRT A-062-ALAS(1), 14-34-0001-8002.

Descriptors: *Alaska, *Model studies, *Environmental effects, *Land clearing, *Agriculture, Barley, Water quality, Water pollution, Fertilizers, Irrigation effects.

Currently, some 53,000 acres of land in the Clearwater Creek watershed (near Delta Junction, Alaska) are being cleared for intensive barley production. Several uncertainties exist with respect to crop water balance, pesticide and fertilizer transport, and effects of irrigation on groundwater and stream levels. Furthermore, there is a general sparcity of site-specific data. This project was to investigate the utility of modeling and simulation to estimate possible interactions of water resources and agricultural development. Many models proved inappropriate for the environmental extremes of Alaska. In addition, excessive time, money and effort were often required to transfer large, comprehensive models from other parts of the country into working tools for this project. An alternative approach using specific, problem-oriented models written in CSMP language proved useful, as well as a mathematically simple water balance accounting model. These models were applied to specific questions of crop water balance and leaching for the Delta-Clearwater project area. Field data were collected on crop water use and also on benthic algae and macroinvertebrates of Clearwater Creek. General guidelines on data collection and utilization were established to aid state agencies charged with monitoring and managing agricultural development.
W80-03711

THE GEOMORPHOLOGIC STRUCTURE OF HYDROLOGIC RESPONSE,
Universidad Simon Bolivar, Caracas (Venezuela).
I. Rodriguez-Iturbe, and J. B. Valdes.
Water Resources Research, Vol 15, No 6, p 1409-1420, December 1979. 8 Fig, 14 Ref.

Descriptors: *Watersheds(Basins), *Geomorphology, *Rainfall, *Runoff, *Model studies, Mathematical models, Hydrologic properties, Rainfall-runoff relationships, Streamflow, Hydrographs, Unit hydrographs, Synthetic hydrology, Hydrology, Hydrologic response, Geomorphic structure.

A unifying synthesis of the hydrologic response of a catchment to surface runoff was attempted by linking the instantaneous unit hydrograph (IUH) with the geomorphologic parameters of a basin. Equations of general character were derived which express the IUH as a function of Horton's numbers R sub A, R sub B, and R sub L; an internal scale parameter L sub omega; and a mean velocity of streamflow nu. The IUH is time varying in character both throughout the storm and for different storms. This variability is accounted for by the variability in the mean streamflow velocity. The underlying unity in the nature of the geomorphologic structure is thus carried over to the great variety of hydrologic responses that occur in nature. An approach was initiated to the problem of hydrologic similarity. (Sims-ISWS)
W80-03743

HYDROLOGIC DATA FOR WELLS, SPRINGS, AND STREAMS IN BOULDER COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, E. L. Boyd, and D. Cain.
Available from: OFSS BX 25425, FED. CTR. Denver, CO printed copy $16.00 microfiche $4.00. Geological Survey open-file report 79-979, November 1979. 106 p, 7 Fig, 1 Plate, 5 Tab, 4 Ref.

Descriptors: *Hydrologic data, *Data collections, *Colorado, *Groundwater, *Surface waters, Wells, Springs, Streams, Water quality, Sampling, Sites, Water temperature, Streamflow, Water analysis, Sewage treatment, *Boulder County(Colo).

Hydrologic data collected in 1975-77 as part of a comprehensive water-resources investigation of Boulder County, Colo., by the U.S. Geological Survey in cooperation with the Boulder County Health Department and the Colorado Geological Survey are presented in this report. The data, in tabular and graphic form, consist of water-quality analyses of selected constituents and geohydrologic-site, water-treatment, and sewage-treatment data for 609 wells and 48 springs; water-quality analyses for 102 of the wells and 9 of the springs; water-quality analyses of streamflow from 34 sites; and specific conductance and water-temperature measurements of streamflow from 3 sites. State and local officials in Boulder County may find these data useful in planning for residential, commercial, and industrial development. (Kosco-USGS)
W80-03757

WATER-QUALITY ASSESSMENT OF THE L'ANGUILLE RIVER BASIN, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-03758

THE RELEASE OF REACTIVE PHOSPHATE BY A POSIDONIA AUSTRALIS SEAGRASS COMMUNITY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
H. Kirkman, F. B. Griffiths, and R. R. Parker.
Aquatic Botany, Vol 6, No 4, p 329-337, August 1979. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Phosphates, *Rooted aquatic plants, *Estuarine environments, *Seagrass, *Port Hacking, Australia, Submerged plants, Posidonia australis, Estuaries, Detritus, Phosphorus compounds, Nutrients, Plant physiology, Water chemistry, Biochemistry, Leaves, Epiphytes, Tides, Diffusion, Metabolism.

Reactive phosphate is released into water over the seagrass Posidonia australis in a sunken river valley South West Arm of Port Hacking, Australia, both day and night; the reactive phosphate enters the water column either by diffusion or tidal flow mechanisms. No release occurs over surrounding unvegetated areas. A series of experiments were conducted to determine if Posidonia plants were the agents by which reactive phosphate was moved from interstitial substrate water to the water column. Two 1 sq m aluminium boxes without tops or bottoms were placed over seagrass beds. Each box enclosed about 330 Posidonia shoots. Plants in one box were individually enclosed in plastic bags so that the water in the bags did not mix with water in the box. Water samples were taken at 15 min intervals over 24 hours. Box experiments show simil increases in reactive phosphate for both covered and uncovered plants. Thus Posidonia plants are not responsible for phosphate release. It is postulated, instead, that the seagrass bed releases reactive phosphate through microbiological remineralization of detritus accumulation from the water column, seagrass leaves and epibiota. Release rates vary 0.055-0.17 micro g - at P/h g leaf dwt. (Harris-Wisconsin)
W80-03808

2B. Precipitation

STATISTICAL ANALYSIS OF HYDROLOGIC CRITICAL DROUGHTS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydrology and Water Power.
For primary bibliographic entry see Field 2E.
W80-03618

FORECASTING STORM RAINFALL OVER BHAGIRATHI CATCHMENT DUE TO DEPRESSIONS/CYCLONIC STORMS,
Meteorological Office, New Delhi (India).
G. R. Gupta, K. K. Srivastava, H. C. Mehra, and T. C. Jasra.
Mausam, Vol 30, No 1, p 139-156, January 1979. 7 Fig, 7 Tab, 4 Ref.

Descriptors: *Storms, *Rainfall, *Forecasting, *Floods, Flood forecasting, Precipitation(Atmospheric), Watersheds(Basins), Rain gages, Networks, Weather, Climatology, Meteorology, *India, *Bhagirathi River(India).

Synoptic typing of systems contributing rainfall in catchment areas were found to be a useful technique in quantitative precipitation forecasting. This paper contained detailed analysis of 68 rainstorm situations with one-day rainfall of 2.5 cm or more over the Bhagirathi catchment during the period 1901-1967 in association with depressions/cyclonic storms. An attempt was made in this paper to: (1) estimate the contribution of rainfall over the catchment vis-a-vis the location of the system; (2) estimate the intensities of the rainfall vis-a-vis the intensities of the causative systems, namely depressions/cyclonic storms; (3) determine the time interval between the origin of the system and its movement to an effective location to cause rainfall over the catchment; (4) make quick assessment of average areal rainfall over the catchment on the basis of rainfall data from selected key stations, using regression equation; and (5) maximize the highest rainstorm of September 26, 1956, by moisture charge method. (Sims-ISWS)
W80-03635

ON THE ASSESSMENT OF CROP DROUGHTS: A CASE STUDY FOR DISA (GUJARAT),
Meteorological Office, Poona (India).
S. Venkataraman.
Mausam, Vol 30, No 1, p 123-128, January 1979. 1 Fig, 4 Tab, 10 Ref, 1 Append.

Descriptors: *Droughts, *Crops, *Evapotranspiration, *Rainfall, Soil moisture, Evaporation, Arid lands, Climatology, Agroclimatology, Agriculture, Meteorology, *India.

The comparative nature of meteorological drought studies was pointed out. A monthly rainfall-cum-two-layer soil model to arrive at the ratio of actual water transpired by a ground-shading crop to the potential transpiration need was presented. The use of such ratios for characterizing the drought situations for a reasonably parameterized crop was explained. A case study for Disa station in Gujarat was presented. (Sims-ISWS)
W80-03637

DOES PRECIPITATION PATTERN FORETELL GUJARAT CLIMATE BECOMING ARID,
Meteorological Office, Poona (India).
A. Chowdhury, and V. P. Abhyankar.
Mausam, Vol 30, No 1, p 85-90, January 1979. 2 Fig, 5 Tab, 4 Ref.

Descriptors: *Rainfall, *Monsoons, *Analysis, Time series analysis, Climates, Arid climates, Precipitation(Atmospheric), Climatology, *India, *Gujarat State(India).

In recent years on account of the anomalous behavior of southwest monsoon, drought conditions were reported from many parts of the country, Gujarat State in particular. An attempt was made in this paper to determine if Gujarat is turning drier. Southwest monsoon (seasonal) and the annual rainfall series of nearly 70 years were subjected to sophisticated statistical analyses. Rainfall data over Gujarat was found to constitute a random series and did not exhibit presence of trend, cycle, or persistence. The precipitation pattern did not indicate that arid conditions are gradually increasing over Gujarat State. It also was not feasible to anticipate years of poor rainfall from the past occurrences in the rainfall series. (Sims-ISWS)
W80-03638

A RAINFALL SIMULATOR WITH NONREPETITIOUS MOVEMENT OF DROP OUTLETS,
Science and Education Administration, Riverside, CA. Salinity Lab.
W. B. Kleijn, J. D. Oster, and N. Cook.
Soil Science Society of America Journal, Vol 43, No 6, p 1248-1251, November-December 1979. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Rainfall simulators, *Simulated rainfall, *Equipment, *Laboratory equipment, Rainfall, Precipitation intensity, Particle size, Drops(Fluids), Engineering, Meteorology, Soil science, Drop-size distributions.

Problems encountered in simulating uniform rainfall inside the laboratory were discussed. A new rain simulator was described which eliminates nonuniformity by a non-repeating movement of drop outlets. The model tested applies rain to a ring-shaped area of 0.21 sq m with a coefficient of variation of about 7%. By using drop outlets of different sizes, one also can adjust the raindrop size distribution. (Sims-ISWS)
W80-03726

2C. Snow, Ice, and Frost

HYDRAULIC CONDUCTIVITY OF MOUNTAIN SOILS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
O. R. Williams, L. Ponce, R. Meiman, and M. Spearnak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153455, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, CO. State Univ., Completion Report No. 92, Sept. 1978. 52 p, 21 Fig, 8 Tab, 31 Ref. OWRT A-032-COLO(1), 14-34-0001-6000.

Descriptors: *Hydraulic conductivity, *Snowmelt runoff, Subalpine watershed, Litterflow, Water conservation, Percolation, *Mountains, Coniferous forest, Forest watersheds, *Soil water movement.

Pathways and rates of delivery of snowmelt runoff from a subalpine conierous forest watershed were studied through the examination of saturated hydraulic conductivity, soil moisture tension and litterflow measurements. Measurements were taken from litterflow collectors and our soil pits 2.5 meters deep located on north and south aspects. During the period of snowmelt, runoff was carried as surface and near-surface flow in the litter layer and upper 4-5 cm of mineral soil. Saturated or near-saturated flow occurred at the base of the soil pits. The majority of the soil profile transmitted soil moisutre as unsaturated flow. Hydraulic conductivity determinations indicated that under saturated conditions the potential percolation through the soil mass would generally be in excess of the normal snowmelt rate.
W80-03775

2D. Evaporation and Transpiration

MEASURING EVAPOTRANSPIRATION OF TURFGRASS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
C. M. Feldhake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152051, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1979. 56 p, 7 Fig, 5 Tab, 26 Ref, Append. OWRT A-043-COLO(1), B-035-WYO(5).

Descriptors: *Evapotranspiration, *Turfgrasses, *Kentucky bluegrass, *Lawns, Lysimeters, Urban lawns, Growth chamber, Canopy temperature, Infrared thermometer, Thermal emissivity.

Evapotranspiration (ET) of Kentucky bluegrass (Poa pratensis L) was measured in urban lawns, in a growth chamber and as part of a study relating canopy temperature to water stress. Lysimeters 30.5 cm in diameter, were used to measure ET. Lack of control over urban lawn sites restricted the reliability of relating ET to microclimate. In the growth chamber study, ET was influenced by day temperature, night temperature, clipping height and soil texture. It was shown that soils high in clay are not desirable for use in lysimeters due to limited root growth. Average midday canopy temperature was more reliable at identifying water stress than daily ET measurements using lysimeters. Canopy temperature measurements, using an infrared thermometer, were utilized without correcting for canopy quality differences since the thermal emissivity of lush, green turf and dead, brown turf was found to be the same. The Barnes 14-220 infrared thermometer was calibrated and it's scale was found to be 8% high for the 0-50C range.
W80-03646

2E. Streamflow and Runoff

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W80-03611

THERMAL MODELING OF HIGHLY TRANSIENT FLOWS IN THE CHATTAHOOCHEE RIVER NEAR ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS.
H. E. Jobson, and T. N. Keefer.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 125-141, 1978. 6 Fig, 5 Ref.

Descriptors: *Thermal water, *Model studies, *Georgia, *Rivers, Water temperature, Streamflow, Routing, Mathematical models, Thermal pollution, Heat transfer, Heat balance, Tracers, Calibrations, Flow, Analytical techniques, Unsteady flow, On-site investigations, *Chattahoochee River(GA).

Coupled flow, temperature, and transport models have been developed and verified by use of two extensive sets of data collected under highly unsteady flow conditions on a 27.9 km reach of the Chattahoochee River between Buford and Norcross, Georgia. Existing solution techniques, with

minor improvements, were applied to verify flow and transport modeling concepts. A linear-implicit finite difference flow model was calibrated by use of a depth profile obtained during steady low flow and unsteady flow data obtained during March 1976. The flow model was verified by use of dynamic stage and discharge data obtained in October 1975. The verification results were considered to be very good, particularly for flows of less than 100 cu m/s. Dye was added to the upstream end of the river reach at a constant rate while the river flow was highly unsteady. The transport model closely simulated observed dye concentrations in the river. Even without calibration the temperature model was capable of predicting temperature changes through the reach of as large as 5.8C with a root-mean-square error of 0.32C in October 1975 and 0.20C in March 1976. Hydropulsation has a significant effect on the water temperature below Buford Dam. These effects are very complicated because they are quite dependent on the timing of the release with respect to both the time of day and past releases. (See also W80-03606) (Humphreys-ISWS)
W80-03615

OPTIMIZATION OF UNIT HYDROGRAPH DETERMINATION,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays, and L. Coles.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, p 85-97, Proceedings Paper 15129, January 1980. 3 Fig, 5 Tab, 12 Ref, 2 Append.

Descriptors: *Unit hydrographs, *Rainfall, *Runoff, *Optimization, *Mathematical models, Model studies, Hydrographs, Synthetic hydrology, Computers, Computer programs, Linear programming, Precipitation(Atmospheric), Rainfall-runoff relationships, Hydrology.

A linear programming model was developed for the optimal determination of unit hydrographs. The model determines the best unit hydrograph by minimizing the sum of deviation between observed and calculated runoff hydrographs. The principles of linearity and superposition of unit hydrograph theory are the basis of the model. Several multi-period rainfall events can be considered simultaneously for the optimal unit hydrograph determination. The model was tested using both hypothetical and actual rainfall events. (Sims-ISWS)
W80-03617

STATISTICAL ANALYSIS OF HYDROLOGIC CRITICAL DROUGHTS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydrology and Water Power.
Z. Sen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15134, p 99-115, January 1980. 16 Fig, 3 Tab, 8 Ref, 2 Append.

Descriptors: *Droughts, *Stochastic processes, Statistical methods, Probability, Statistics, Markov processes, Analytical techniques, Analysis, Rivers, Flow, Hydrology, *Statistical analysis, Random variables.

Analytical formulations of critical droughts either as longest drought duration or maximum deficit sum were derived by making use of the theories of random number of random variables and runs. The results obtained are valid for independent and lag-one Markov processes only. The numerical solution of derived analytical expressions yields any order of statistical moments, the most important one is the expected value of critical droughts. It was quantitatively observed that the drought duration and severity are dependent on the correlation structure, sample size, and truncation level. (Sims-ISWS)
W80-03618

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
T. J. Smith, and H. S. Takhar.
Journal of Hydraulic Research, Vol 17, No 4, p 329-340, 1979. 7 Fig, 22 Ref.

Descriptors: *Turbulent flow, *Estuaries, *Turbulent boundary layers, Hydraulics, Waves(Water), Open channel flow, Open channels, Velocity, Equations, Shear, Stress, Mathematical models, Analytical techniques, Analysis, Laboratory tests, Flow, *Turbulence energy closure models, Width-average flow, Long waves.

This paper described the use of mean turbulence energy closure models for the calculation of the vertical structure of the width-averaged flow due to the propagation of long waves in an open channel of constant width and rectangular cross section. Two turbulence models were considered which required the solution of one or both of the differential equations governing the turbulence energy and its dissipation rate. Numerical solutions were obtained for the motion induced by long waves in a laboratory channel and in the Humber Estuary. The computed values of surface velocity and bed shear stress in the laboratory channel were found to agree well with observed values. The calculation procedure also accurately reproduced the vertical structure of the tidal flow in the Humber Estuary. Existing theoretical relationships for the bed shear stress under long waves were verified by the numerical calculations, and a distribution of the dissipation length scale, postulated on physical grounds, was also confirmed. It was concluded that turbulence models of this type represent powerful research tools for the study of long waves, especially those which occur in nature. (Lee-ISWS)
W80-03619

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
For primary bibliographic entry see Field 8B.
W80-03620

TURBULENCE MEASUREMENTS IN THE BOUNDARY LAYER OVER A SAND WAVE FIELD,
Washington Univ., Seattle. Dept. of Oceanography.
S. R. McLean, and J. D. Smith.
Journal of Geophysical Research, Vol 84, No C12, p 7791-7808, December 20, 1979. 17 Fig, 5 Tab, 22 Ref. DOE EY-76-S-06-2225 TA 25, NSF GA14178.

Descriptors: *Turbulence, *Sand waves, *Rivers, *Columbia River, Measurement, Current meters, Flow, Beds under water, River beds, Stress, Streamflow, Boundary layers, Data processing, Analytical techniques, Hydrology, Power spectra.

To assist in elucidating the turbulent structure of flow over regular sets of bed forms, data procured with small mechanical current meters above 2 m high, 96 m long sand waves in the Columbia River were analyzed. The high frequency resolution of the flow sensors and the half hour records that were collected with them were shown to be sufficient to yield reliable Reynolds stresses. In addition, an expression from which the sampling error in Reynolds shear stresses can be estimated from the sampling frequency, the local flow speed, and the distance from the boundary was presented. Although the kappa to the (-5/3) power region of the energy spectrum was found, the conditions for isotropy were not satisfied anywhere within the measured band. Spatial structure of the Reynolds stress components was found to be complicated in character but explicable in basic fluid mechanical terms. Owing to the near boundary effects of form drag induced by the sand waves, the spatially averaged shear stress increased from 20 dyn/sq cm at 35 cm to 40 dyn/sq cm at 100 cm. Furthermore, the Reynolds shear stress was found to vary with the structure of the variance of the vertical velocity component rather than with that of turbulent kinetic energy as assumed in the simple closure models that have been used so far in theories for flow over such bed forms. (Sims-ISWS)
W80-03626

HYDRAULICS OF FLOW IN THE KASKASKIA RIVER, ILLINOIS,
Illinois State Water Survey, Urbana.
N. G. Bhowmik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153448, Price codes: A06 in paper copy, A01 in microfiche. ISWS Report of Investigation 91, 1979. 116 p, 73 Fig, 13 Tab, 46 Ref, 2 Append.

Descriptors: *River flow, *Flow characteristics, *Illinois, *On-site investigations, Open channel flow, Streambeds, Data collections, Low flow, Roughness(Hydraulic), Head loss, Hydraulics, Meanders, On-site tests, Geomorphology, Particle size, Bottom sediments, Velocity, Flow profiles, Spatial distribution, Water circulation, Discharge(Water), Analytical techniques, Analysis, *Kaskaskia River(IL), Pools, Riffles, River bends.

The hydraulics of flow was investigated at two reaches in the Kaskaskia River. Hydraulic data were collected for 58, 1040, 1420, and 4000 cfs from Reach 1 below Lake Shelbyville and for 290, 2160, and 3700 cfs from Reach 2 below Carlyle Lake. The flow frequencies varied from 5 to 88%. In all, 79 bed and bank material samples were collected and analyzed to determine the particle size distribution. In all cases, the flow can be approximated by uniform flow equations. Head loss varied from 0.96 ft/mile for high flows to 1.98 ft/mile for low flows. The vertical velocity distribution was found to follow a logarithmic distribution. The average velocity at 0.5 foot above the bed was approximately 95% of the average velocity in the cross section. Altogether 79 isovels, or lines of equal velocity, in the cross sections were developed on the basis of the hydraulic data collected in the field. The ratio of the maximum velocity to the average velocity remained almost unchanged for low, medium, and high flows. In a few cross sections, a considerable amount of bed scour took place during high flows. A theoretical distribution was found to predict the lateral velocity distribution in the bends satisfactorily. The average value of the energy coefficient was 1.45 for straight reaches and 1.43 for bends. Similarly, the average value of momentum coefficients was 1.22 for straight reaches and 1.18 for bends. Average Manning's roughness coefficients varied from a minimum of 0.039 to a maximum of 0.053. During low flows, the Kaskaskia flows through a series of pools and riffles with larger diameter bed materials in the riffle and fine materials in the pool. The median diameter varied from 40 mm in the riffle to 0.04 mm in the pool. The Froude number varied from 0.7 in the riffle to 0.01 in the pool. Head loss was about 2.48 ft/mile in one pool-riffle sequence and about 4.44 ft/mile in another. During high flows, the pools and riffles are all submerged, and their effects on the overall flow condition are minimal or nonexistent. (Humphreys-ISWS)
W80-03713

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W80-03725

A GENERALIZED APPROACH TO KINEMATIC FLOOD ROUTING,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
A. A. Smith.
Journal of Hydrology, Vol 45, No 1/2, p 71-89, January 1980. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Flood routing, *Flood waves, *Model studies, Mathematical models, Flow, Water levels, Streamflow, Storage, Reservoirs, Reservoir storage, Flood profiles, Computer models, Equations, Analytical techniques, Hydrology, Kinematic flood routing.

The development of the kinematic wave flow routing equation was presented briefly, and certain of the fundamental conditions necessary for its successful application were discussed. A general algorithm was proposed, and several methods of kinematic routing in common usage were shown to be special cases of the algorithm. The performance of the finite-difference scheme was examined with respect to stability and convergence; truncation error was shown to be independently sensitive to weighting factors in the space and time dimensions. From this an explicit relationship was developed between these weighting factors and the numerical attenuation of the wave. Confirmatory evidence from numerical experiments was presented. Comparison with the diffusion form of the equation showed how the diffusion coefficient may serve to relate the space and time weighting factors and the physical properties of the channel system. Application to nonprismatic or natural channels was discussed. Finally, implementation of the algorithm in computer routines for the routing of flood waves in natural channels was discussed, including a recent development in which the weighting factors are made time dependent. (Sims-ISWS)
W80-03732

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
G. Abraham, M. Karelse, and A. G. van Os.
Journal of Hydraulic Research, Vol 17, No 4, p 273-287, 1979. 6 Fig, 2 Tab, 28 Ref.

Descriptors: *Stratified flow, *Subcritical flow, *Interfaces, *Model studies, Flow, Stability, Flow characteristics, Density currents, Boundary processes, Saline water-freshwater interfaces, Saline water intrusion, Mathematical models, Laboratory tests, Analytical techniques, Shear, Steady flow, Locks, Navigation, Water temperature, Two-layer flow, Salt wedge, Temperature surface wedge.

This paper elaborated upon the reasons why subcritical stratified flows may be treated as two-layer flows without mixing. The following stratified flow phenomena may be characterized as subcritical steady stratified flows: (1) arrested salt wedge, (2) temperature surface wedge, and (3) density-induced return currents. In internal mixing processes distinction must be made between the role of internal waves and turbulence. An important property of turbulence is its ability to transport quantities such as salt or heat across surfaces of constant density. There is little connection between the turbulent motion at well separated points in the fluid, and turbulent energy propagates slowly, with the speed of the fluid motion. Waves, on the other hand, may distort the density distribution to produce an apparent, transient layering, but they cannot permanently change the stratification unless they break to produce turbulence. They transfer energy more rapidly through the fluid, varying only gradually as they do so. The conditions at the interface between the two layers of a subcritical stratified flow were considered on the basis of linear instability theory. It was shown that in subcritical stratified flows there is a tendency towards the development of an intermediate layer. This intermediate layer was shown to have a stabilizing effect as it eliminates instability of internal waves. Apparently it also reduces turbulence, as follows from the fact that the considered subcritical stratified flows may be treated as two-layer flows without mixing. The interfacial shear coefficient is likely to vary with the stage of development of the intermediate layer. Further, a summary of experimental data on the interfacial shear was given. The different types of subcritical stratified flows were treated separately as the significance of turbulence generated at the interface in comparison with turbulence generated at the bottom, and vice versa, varies with the type of stratified flow. (Humphreys-ISWS)
W80-03738

HYDRAULICS OF RECTANGULAR VERTICAL DROP STRUCTURES,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
M. A. Gill.
Journal of Hydraulic Research, Vol 17, No 4, p 289-302, 1979. 8 Fig, 4 Tab, 9 Ref.

Descriptors: *Spillways, *Structures, *Hydraulic structures, *Irrigation canals, Canals, Canal design, Hydraulics, Flow, Velocity, Channel flow, Equations, Model studies, Reviews, *Vertical drop spillways, Free drop structures.

Previous works of Moore, White, and Rand on the characteristics of the free overfall drop structures were briefly reviewed. A simple theory initially proposed by White was modified by introducing less drastic assumptions than the ones on which White's theory is based. The resulting theory is in closer agreement with experiment and the empirical equations of Rand than is White's theory. Experimental results were also given on the brink depth as an appendix. (Lee-ISWS)
W80-03739

HYDRAULICS OF A LARGE CHANNEL PAVED WITH BOULDERS,
Ministry of Works and Development, Wellington (New Zealand). Power Div.
S. M. Thompson, and P. L. Campbell.
Journal of Hydraulic Research, Vol 17, No 4, p 341-354, 1979. 7 Fig, 4 Tab, 17 Ref.

Descriptors: *Open channels, *Channels, *Open channel flow, Boulders, Hydraulics, Channel morphology, Channel improvement, Friction, Flow, Equations, *Loose boulders, Darcy friction coefficient, Channel stability.

Experience was described of a 41 m wide by 308 m long, open channel on a 0.052 slope, constructed of loose boulders and through which flows up to 140 cu m/sec are passed. A new expression for the Darcy friction coefficient was proposed with a theory based on published laboratory data. This equation was shown to fit the large channel and other published field data. Some observations were made on both the geometry and the stability of the paving. (Lee-ISWS)
W80-03741

THE GEOMORPHOLOGIC STRUCTURE OF HYDROLOGIC RESPONSE,
Universidad Simon Bolivar, Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-03743

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7C.
W80-03744

STANDARDS, OPTIMALITY AND RESILIENCE IN WATER-RESOURCE MANAGEMENT,
Harvard Univ., Cambridge. Div. of Applied Sciences.
For primary bibliographic entry see Field 6A.
W80-03750

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03754

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-2. SOUTHWEST FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03755

A TECHNIQUE FOR ESTIMATING HEIGHTS REACHED BY THE 100-YEAR FLOOD ON UNREGULATED, NONTIDAL STREAMS IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
R. W. Coble.
Geological Survey Water-Resources Investigations 79-69 (open-file report), July 1979. 14 p, 9 Fig, 2 Ref.

Descriptors: *Analytical techniques, *Peak discharge, *Floods, *Streams, *North Carolina, Flood recurrence interval, Forecasting, Estimating, Streamflow, Gaging stations, Drainage area, Regression analysis, Flood profiles, Maps, Appalachian Mountain region, Coastal Plains, *Piedmont.

A method for estimating heights reached by floods having a recurrence interval of 100 years is defined for nontidal streams with unregulated flows in North Carolina. The flood heights are the vertical distance between stream stage at median discharge (50 percent duration) and the 100-year flood stage and are defined for streams draining areas between 1 and 10,000 square miles. A flood-height drainage-area relation was determined by regression analysis for each of the three physiographic areas of the State; mountains, Piedmont and Coastal Plain. An illustrated example of how the method can be used in conjuction with topographic maps to estimate flood heights and delineate inundated areas by interpolation is given. (Kosco-USGS)
W80-03764

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE PECATONICA-SUGAR RIVER BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
D. A. Stedfast.
Geological Survey open-file report 79-1274 (WRI), August 1979. 92 p, 6 Fig, 2 Plates, 3 Tab, 17 Ref.

Descriptors: *Low flow, *Flow characteristics, *Streamflow, *Low-flow frequency, *Wisconsin, Watersheds(Basins), Streamflow forecasting, Base flow, Analytical techniques, Regression analysis, Gaging stations, Evaluation, *Pecatonica-Sugar River basin(Wis).

Low-flow characteristics of streams in the Pecatonica-Sugar River basin in Wisconsin are presented in tables. Included are estimates of low-flow frequency and flow duration at 11 gaging stations; low-flow frequency characteristics at 25 low-flow partial-record stations and 63 miscellaneous sites; and a list of base-flow discharge measurements at 160 miscellaneous sites. Equations are provided to estimate low-flow characteristics at sites without discharge measurements and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the low-flow characteristics. Standard error provides the user with the expected degree of accuracy for each method. (Kosco-USGS)
W80-03765

A PARAMETRIC MODEL CALIBRATED WITH A PHYSICALLY BASED MODEL FOR RUNOFF PREDICTION FROM UNGAGED STREAMS,
Battelle Pacific Northwest Labs., Richland, WA.
F. W. Bond, D. L. Chery, Jr., and E. S. Simpson.
Water Resources Bulletin, Vol 15, No 6, p 1640-1652, December 1979. 6 Fig, 8 Ref.

Descriptors: *Runoff, *Surface runoff, *Model studies, *Mathematical models, Streamflow, Watersheds(Basins), Calibrations, Rainfall, Hydrographs, Forecasting, Hydrology, Ungaged streams, Runoff prediction, Surface flow modeling.

Recent developments in the numerical solution of the governing partial differential equations for overland and channel flow should make possible physically based models that predict runoff from

ungaged streams. However, these models, which represent the watershed by sets of intersecting planes, are complex and require much computer time. Parametric models exist that have the advantage of being relatively simple, and once calibrated are inexpensive to use and require limited data input. In this study, a procedure was developed for calibrating a parametric model against a physically based model, utilizing base areas of one acre and one square mile, with the expectation that base areas can be combined to model real watersheds. Simulation experiments with the physically based model showed that for the one-acre base area, the dominant parameter (cell storage ratio, K) related to the slope and friction of the planes, whereas for one-square-mile areas, the dominant parameters (K plus a lag factor, L) relate to channel properties. These parameters decreased exponentially as rainfall intensity increased. (Sims-ISWS)
W80-03839

2F. Groundwater

COMPARATIVE STUDY OF GROUNDWATER RECHARGE RATES IN PARTS OF INDO-GANGETIC AND SABARMATI ALLUVIAL PLAINS,
Physical Research Lab., Ahmedabad (India).
P. S. Datta, B. I. Desai, and S. K. Gupta.
Mausam, Vol 30, No 1, p 129-133, January 1979. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Groundwater, *Recharge, *Groundwater recharge, *Soil water movement, Rainfall, Irrigation, Soil water, Aquifers, Tracers, Tritium, Evapotranspiration, Runoff, Mathematical models, On-site investigations, *India.

Tritium-tracing data of soil moisture movement for groundwater recharge estimation from four river basins in India were examined. Of the two commonly used empirical formulae, namely, Amritsar and Chaturvedi formulae, the former gives consistently higher estimate of groundwater recharge in all four regions. The Chaturvedi formula gives reasonable estimates of groundwater recharge for sandy loam soils in parts of Indo-Gangetic plains, but gives significantly higher values of groundwater recharge for similar soils in Sabarmati basin. For each basin based on tritium tracing of soil moisture movement, empirical relations were developed to estimate regional groundwater recharge. Since the hydrometeorological factors vary significantly from basin to basin and within parts of a basin, it is desirable to investigate each region individually. (Sims-ISWS)
W80-03636

PAUL SPRING: AN INVESTIGATION OF RECHARGE IN THE ROSWELL (NM) ARTESIAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
G. W. Gross, P. Davis, and K. R. Rehfeldt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-150758, Price codes: A10 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces; Report No 113, December 1979. 135 p, 26 Fig, 8 Tab, 25 Ref, 5 Append. OWRT A-055-NMEX(2), 14-34-0001-6032.

Descriptors: *Natural recharge, *Artesian aquifers, *Tritium, Groundwater movement, Dating, Recharge, Spring waters, New Mexico, Perched aquifer, *Spring flow, Deep flow, Paul Spring(NMex), Roswell(NMex).

Paul Spring is the principal or sole discharge point of a perched localized aquifer of well defined boundaries. It is located on the western flank of the Roswell artesian basin, and conditions at Paul Spring are considered typical for a major portion of the basin. The recharge at Paul Spring could therefore provide insight into the recharge mechnisms controlling the basin's groundwater supply. The geology of the area was mapped in detail. Springflow was measured over a span of 453 days. Precipitation records of many years were available from a NOAA weather station in the area. Tritium was measured in spring discharge and precipitation. Numerical and stochastic analysis and cross-correlation were performed on the data. The results suggest that a deep flow component plays an important role, hitherto underestimated, in the groundwater recharge to the basin. This deep component is transmitted by the Permian Yeso Formation and the Glorieta Sandstone Member of the San Andres Formation. At Paul Spring, this accounts for as much as 80% of the discharge. No clear results were obtained for the Paul Spring aquifer's response time to precipitation events. The indications are that it is of the order of several months. This can be explained by the peculiar geologic structure, specifically the screening effect of the Glorieta sandstone, in combination with solution and collapse features in the Yeso formation which channel the recharge water. A longer series of springflow measurements under better controlled conditions is needed to clarify this problem. (Herman-NMex)
W80-03642

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6A.
W80-03710

PREPARATION OF FRIABLE AQUIFEROUS SPECIMENS,
Humphreys (Howard) and Partners, Reading (England).
For primary bibliographic entry see Field 8E.
W80-03719

MIXING MODELS AND IONIC GEOTHERMOMETERS APPLIED TO WARM (UP TO 60C) SPRINGS: JORDAN RIFT VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
For primary bibliographic entry see Field 2K.
W80-03728

HYDROLOGY OF SMALL OCEANIC ISLANDS--UTILITY OF AN ESTIMATE OF RECHARGE INFERRED FROM THE CHLORIDE CONCENTRATION OF THE FRESHWATER LENSES,
Washington State Univ., Pullman. Dept. of Geology.
H. L. Vacher, and J. F. Ayers.
Journal of Hydrology, Vol 45, No 1/2, p 21-37, January 1980. 8 Fig, 18 Ref, 1 Append.

Descriptors: *Recharge, *Groundwater recharge, *Islands, Natural recharge, Hydraulic conductivity, Evapotranspiration, Coasts, Aquifers, Tracers, Chlorides, On-site investigations, On-site data collections, Data processing, Mathematical models, Hydrogeology, *Bermuda.

In Bermuda, as in other coastal and oceanic-island environments, rainfall has a significant chloride concentration. As a result, there is a relatively straight-forward way of estimating groundwater recharge by considering the Cl(-) ion as a tracer which is concentrated by evapotranspiration. The Cl(-) concentration of rainfall in Bermuda is about 15 ppm. That of the freshest part of the largest Ghyben-Herzberg lens is about 60 ppm. Taking the 60 ppm value as an indicator of the Cl(-) concentration of recharge, the average recharge rate is estimated at 0.25 of the 147-cm/yr average rainfall, or about 37 cm/yr. This estimate is similar to two other estimates of recharge in Bermuda, each derived from hydrogeologic field data: (1) a 33-cm/yr estimate inferred from a 2000000-sq m area of diversion in which outflows (extractions) are 2870 cu m/day and the change in storage is estimated at 1100 cu m/day, from the rate of lowering of the water table; and (2) an estimate of 35 to 45 cm/yr resulting from combination of the ratio of recharge to hydraulic conductivity of the Paget Formation (0.000012), determined from the configuration of the Ghyben-Herzberg lenses, and the hydraulic conductivity of the Paget Formation (85-100 m/day), estimated from the behavior of the water table. The agreement between the three estimates of recharge indicated that the rather simple and inexpensive technique of calculating recharge from Cl(-) content of rainfall and fresh groundwater can be a useful addition to the arsenal of techniques by which recharge of small oceanic islands can be evaluated. (Sims-ISWS)
W80-03729

KINETICS OF CHEMICAL PROCESSES IN A CARBONATE AQUIFER: A CASE STUDY OF WATER-ROCK INTERACTION IN THE AQUIFER OF WESTERN AND CENTRAL GALILEE (ISRAEL),
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 2K.
W80-03730

OCEAN TIDE EFFECT STUDY ON A COASTAL CARBONATE AQUIFER (MIOCENE OF ALGARVE, PORTUGAL) ((ETUDE DE L'EFFET DE MAREE OCEANIQUE SUR UN AQUIFERE CARBONATE COTIER (MIOCENE DE L'ALGARVE--PORTUGAL)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
M. Razack, C. Drogue, C. Romariz, and C. Almeida.
Journal of Hydrology, Vol 45, No 1/2, p 57-69, January 1980. 5 Fig, 3 Tab, 8 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Aquifers, *Tidal effects, Coasts, Mathematical models, Analytical techniques, Carbonate rocks, Limestones, Foreign research, On-site investigations, Diffusivity, Porous media, Hydraulic conductivity, Confined water, Aquifer characteristics, *Portugal.

The study of groundwater-table variations due to ocean-tide effects in a coastal aquifer may yield, under certain conditions, its hydrodynamical characteristics. Such a study was attempted about a zone of the limestone aquifer of the Miocene of Algarve (Portugal). Two computation methods can be utilized, depending on the form of the free-water table evolution: (1) a Carson-Laplace transform, or (2) adjustment of a sinusoidal variation law to the fluctuations. Their application permitted characterization of the aquifer's general hydrodynamical behavior. The model gives the most satisfying reconstitutions of the observations, particularly points out a seepage situation which fits quite well to the known geological conditions of the aquifer. (Humphreys-ISWS)
W80-03731

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7C.
W80-03744

GEOHYDROLOGIC MODEL OF THE FLORIDAN AQUIFER IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Univ., Gainesville. Dept. of Geology.
A. F. Randazzo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151475, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No 46, 1980. 79 p, 22 Fig, 11 Tab, 72 Ref. OWRT B-032-FLA(3), 14-34-0001-7148.

Descriptors: *Aquifer characteristics, *Groundwater movement, *Porosity, *Permeability, *Ground-water resources, *Aquifer management, Limestones, Petrography, Water management, Aquifers, Facies, Diagenesis, Florida, Southwest Florida.

Nineteen carbonate rock cores from the Southwest Florida Water Management District and adjacent counties were analyzed by megascopic, microscop-

ic, X-ray diffraction, and atomic adsorption spectrometry techniques for the determination of lithofacies paleontology, mineralogy, and geochemistry. These wells penetrate biozones representative of the 'Tampa', Suwannee, Ocala, Avon Park, and Lake City Formations. Numerous depositional cycles were recognized by cyclic occurrences of rock types and depositional environments. Two processes of dolomitization are suggested: homogeneous dolomitization resulting in single-stage development of microtextured aphanotopic, peloidal and mosaic fabrics; and heterogeneous dolomitization resulting in multi-stage development of porphyrotopic and some mosaic fabrics. The pattern of crystallization fabric distribution appears to be related to sedimentologically defined depositional cycles. The type of visible porosity can be related to the type of crystallization fabric. Greatest total porosity is found in cavernous zones associated with formational contacts. Geochemical evidence supports a mixing zone model of diagenetic dolomitization for the Floridan Aquifer. Variations in sea level and fluctuations of the phreatic zone could cause the dolomitizing solutions to contact large volumes of rock through time, resulting in thick sequences of dolomite. (Heaney)
W80-03751

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3B. SOUTHWEST FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03756

STRUCTURAL CONTROLS OF HOT-SPRING SYSTEMS IN SOUTHWESTERN MONTANA,
Montana State Univ., Bozeman; and Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-03760

GROUND WATER IN THE SAN JUAN BASIN, NEW MEXICO AND COLORADO,
Geological Survey, Albuquerque, NM. Water Resources Div.
F. P. Lyford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108020, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-73, May 1979. 22 p, 11 Fig, 27 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Aquifer characteristics, *Geology, Water quality, Water resources, Groundwater movement, Transmissivity, Dissolved solids, New Mexico, Colorado, *San Juan Basin.

Principal aquifers in the San Juan Basin of New Mexico and Colorado are the Entrada Sandstone, Westwater Canyon Member of the Morrison Formation, Gallup Sandstone of the Mesaverde Group, several sandstones in the Mesaverde Group above the Gallup (Dalton Sandstone Member of the Crevasse Canyon Formation, Point Lookout Sandstone, Menefee Formation, Cliff House Sandstone), and sandstones of Tertiary age. Most ground water flows from topographically high outcrop areas toward the San Juan River and Rio Grande valley. Much of the water may move through confining layers to other aquifers or to the land surface rather than discharging directly to the streams. Transmissivities of the sandstones range from 50 to 300 square feet per day. Lowest dissolved-solids concentrations occur in or near outcrops of the sandstones and increase in the direction of groundwater flow. Concentrations range from less than 500 milligrams per liter to more than 30,000 milligrams per liter. (Kosco-USGS)
W80-03763

GROUND-WATER RESOURCES OF GRANT AND SIOUX COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
P. G. Randich.
North Dakota County Ground-Water Studies 24--Part III, and North Dakota Geological Survey Bulletin 67--Part III, 1979. 49 p, 19 Fig, 5 Plates, 3 Tab, 52 Ref.

Descriptors: *Groundwater resources, *North Dakota, *Aquifer characteristics, *Water yield, *Water quality, Chemical properties, Potential water supply, Hydrogeology, Water wells, Water level fluctuations, Data collections, Maps, Hydrographs, Water utilization, *Grant County(N Dak), *Sioux County(N Dak).

Ground water in Grant and Sioux Counties is obtainable from aquifers of Late Cretaceous, Tertiary, Pleistocene, and Holocene age. The major bedrock aquifers in the counties are the Fox Hills and Hell Creek aquifers of Late Cretaceous age and the Cannonball and Ludlow, undifferentiated, and Tongue River aquifers of Tertiary age. Potential yields to individual wells range from about 5 to 150 gallons per minute. The water generally is soft and high in dissolved solids. Aquifers of Pleistocene age--the Shields, Elm Creek, St. James, Beaver Creek, and Battle Creek aquifers--underlie about 48 square miles in Grand and Sioux Counties. Well yields of as much as 1,000 gallons per minute are obtainable in a few places along the central axes of these aquifers. The major dissolved constituents in water from these aquifers are calcium, magnesium, sodium, bicarbonate, and sulfate. Aquifers of Holocene age are located in the alluvial deposits in the Cannonball River, Heart River, and Cedar Creek valleys. Potential well yields generally are less than 50 gallons per minute. (Kosco-USGS)
W80-03767

DEVELOPMENT OF GROUND WATER IN THE HOUSTON DISTRICT, TEXAS, 1970-74,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-03768

SELECTED HYDROLOGIC DATA FOR SPOKANE VALLEY, SPOKANE, WASHINGTON, 1977-78,
Geological Survey, Tacoma, WA. Water Resources Div.
E. L. Bolke, and J. V. Vaccaro.
Geological Survey open-file report 79-333, 1979. 98 p, 2 Fig, 1 Plate, 3 Tab, 6 Ref.

Descriptors: *Washington, *Hydrologic data, *Groundwater, *Basic data collections, *Water quality, Model studies, Computer models, Streamflow, Aquifers, Water wells, Springs, Water levels, Chemical analysis, *Spokane(Wash), Spokane Valley(Wash).

This report presents the ground-water data collected from March 1977 to May 1978 in the Spokane Valley, Spokane, Washington, for the purpose of developing a computer simulation of flow and mass transport in the Spokane aquifer. Data collected include an inventory of wells and springs, water-level data, and chemical analyses of water from selected wells and springs. (Kosco-USGS)
W80-03769

2G. Water In Soils

COMPARATIVE STUDY OF GROUNDWATER RECHARGE RATES IN PARTS OF INDO-GANGETIC AND SABARMATI ALLUVIAL PLAINS,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 2F.
W80-03636

DETERMINATION OF SELECTED HYDRAULIC PROPERTIES OF SUBARCTIC SOILS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-150956, Price codes: A03 in paper copy, A01 in microfiche. Completion Report 78-22, January 1980. 27 p, 8 Fig, 2 Tab, 25 Ref, 2 Append. OWRT A-064-ALAS(3).

Descriptors: *Soil water movement, *Subartic, *Alaska, *Cold regions, Snowmelt, Ablation, Permeability, Hydraulic conductivity, Porosity, Permafrost, Soil physical properties, Ice, Subsurface drainage, Runoff, Groundwater recharge.

The critical hydraulic properties of partially frozen soils were studied to aid in the evaluation of potential groundwater recharge and in forecasting surface runoff. Specific areas examined were (1) the redistribution of moisture in near-surface soils during winter, (2) infiltration rates for partially frozen soils, (3) the role of soil moisture content in runoff generation, (4) the hydrologic significance of surface organic soils, and (5) the importance of permafrost terrain in surface runoff generation. It was found that for snowmelt infiltration, the movement of soil water to the ground surface in winter drastically alters infiltration rates by forming an ice-rich zone at the surface. The higher the soil moisture content the greater the blockage at the surface. In many northern areas organic soil layers up to 50+ cm cover the permafrost terrain. The infiltration capacity of this organic layer is much higher than that of the underlying, sometimes frozen, mineral soils of the permafrost. If this organic layer is heavily saturated as it is during certain seasons of the year, incoming precipitation is rapidly translated into downslope flow and stream flow. Study results were presented at the Canadian Hydrology Symposium: 79-Cold Climate Hydrology and at the American Geophysical Union-Cold Regions Soil Water Problems. Copies of two papers presented at the symposiums are included. (See W80-03649 and W80-03650) (Seigler-IPA)
W80-03648

HYDROLOGIC ROLE OF SHALLOW ORGANIC SOILS IN COLD CLIMATES,
Pacific Northwest Forest and Range Experiment Station, College, AK. Inst. of Northern Forestry.
C. W. Slaughter, and D. L. Kane.
In: Determination of Selected Hydraulic Properties of Subarctic Soils, January 1980. Reprint of paper presented at Canadian Hydrology Symposium: 79 Cold Climate Hydrology, National Research Council of Canada, May 10-11, 1979, Vancouver, British Columbia. 10 p, 3 Fig, 1 Tab, 16 Ref. OWRT A-064-ALAS(1).

Descriptors: *Alaska, *Organic soils, *Permafrost, *Subarctic, *Runoff cold regions, Hydrographs, Watersheds(Basins), Permeability, Porosity, Saturated flow, Soil physical properties, Soil water movement, Subsurface drainage, Ice.

The effect on runoff of relatively shallow organic soils (20 to 50+ cm) that cover mineral soils in subarctic areas such as the Yukon-Tanana Uplands of Alaska is examined. When the organic layer is underlain by impermeable permafrost, a typical condition, rainfall or snowmelt causes the organic layer to become saturated. Water then moves rapidly downslope through the organic layer contributing significantly to surface runoff and creating a shallow water retention area. When the organic layer is not underlain by permafrost more infiltration into the lower mineral soil is possible resulting in less runoff. Factors affecting the role of organic soils in runoff include thermal, hydraulic, and physical properties such as bulk density, pore pressures, hydraulic conductivity, moisture content, and ice content. Seasonal conditions also result in changes. In winter organic soils that were moist at the time of 'freeze up' contribute moisture to the covering winter snowpack by vertical transport. Estimates are at 25 to 30% of the water equivalent of the snowpack. This desiccates the organic layer in winter and at least some of the spring snowmelt is utilized to satisfy this moisture deficit in the organic layer. In summer the organic layer acts as a shallow aquifer of downslope water movement into streamflow. To verify these conditions streamflow from two subdrainage systems of the Caribou-Poker Creeks Research Watershed were examined. Basin C-2 has about 3.5% permafrost by area while basin C-3 has about 53% permafrost. Results show that the permafrost dominated basin C-3 'flashier' in flow with high peak flows and low base flows

when compared to the C-2 basin. (See also W80-03648) (Seigler-IPA)
W80-03649

SNOWMELT INFILTRATION INTO SEASONALLY FROZEN SOILS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
In: Determination of Selected Hydraulic Properties of Subarctic Soils, January 1980. Reprint of paper presented at Cold Regions Soil Water Problems, American Geophysical Union, September 19-20, 1979, Calgary, Alberta. 9 p, 5 Fig, 1 Tab, 9 Ref. OWRT A-064-ALAS(2).

Descriptors: *Permafrost, *Infiltration, *Alaska, *Soil moisture, *Soil water, *Frozen soils, Ice, Porosity, Soil water movement, Snowmelt, Ablation, Loam, Silts, Gravimetric analysis, Permeability, Winter, Hydraulic conductivity, Pores.

The transmission properties of frozen unsaturated silt loam near Fairbanks, Alaska, were examined. The relationship of infiltration rate to soil moisture content was also studied. Because the techniques used were those accepted for determining the properties of unfrozen, unsaturated flow, exact results were not obtained but possible ranges of values for a given condition were. Infiltration rates were measured by filling an augerhole (11.1 cm in diameter and 20 cm in depth) with 0C water. This was done for both frozen and unfrozen soils. Moisture content measurements were made at several field sites by taking a soil core and using gravimetric analysis. Varying temperatures and organic contents were considered. Infiltration tests were conducted and infiltration curves were developed for the various conditions. Results show that the redistribution of soil water towards the ground surface in winter can drastically alter infiltration rates for frozen soils. As water moves to the surface in winter it forms an ice-rich zone near the ground surface by blocking soil pores. The higher the moisture content of soils, the more ice present in the frozen soil portion. This ice layer reduces infiltration from snowmelt and also reduces saturated hydraulic conductivity. (See also W80-03648) (Seigler-IPA)
W80-03650

A HYSTERESIS MODEL BASED ON AN EXPLICIT DOMAIN-DEPENDENCE FUNCTION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Y. Mualem, and E. E. Miller.
Soil Science Society of America Journal, Vol 43, No 6, p 1067-1073, November-December 1979. 6 Fig, 11 Ref. NSF ENG 7800845.

Descriptors: *Hysteresis, *Mathematical models, *Pore water, *Pore pressure, Capillary water, Equations, Drying, Curves, Computer programs, Moisture content, Theoretical analysis, Laboratory tests, Domain water, Pore-water distribution function, Air-entry blockage.

A quantitative model of hysteresis is proposed, assuming the pore-water blockage against air entry to be a direct function of the volume of pore domains located in the completely filled region of the state diagram. The relative volume of the pore-water domains theta sub o, evaluated from the history of the capillary head psi assuming the domains are independent, is employed in a dependency correction function P* sub d (theta sub o). For calibration, this model requires only the main loop of hysteresis and one drying scanning curve. The merit of this 'Model III sub expl' compared with Model III is that any hysteretic process of wetting and drying is expressed analytically in explicit form. This property simplifies the computational procedure and saves computer time in practical application. The overall agreement between predicted and measured hysteretic behavior is acceptable. However, the study reveals that in the range of the air entry value the model does not reproduce the main drying curve accurately if it diverges considerably from the drying scanning curve. This deficiency may reflect the less physical ground for Model III sub expl compared to the implicit Model III. (Visocky-ISWS)
W80-03720

MEASURED AND APPROXIMATE FLUX-CONCENTRATION RELATIONS FOR ABSORPTION OF WATER BY SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
I. White.
Soil Science Society of America Journal, Vol 43, No 6, p 1074-1080, November-December 1979. 8 Fig, 9 Ref.

Descriptors: *Soil water, *Absorption, *Soil moisture, *Model studies, Mathematical models, Soil water movement, Steady flow, Infiltration, Soils, Irrigation, Soil properties, Soil science, Flux-concentration relations, Constant concentration, Constant flux.

The flux-concentration relation of Philip (1973) was calculated using moisture profiles measured during absorption of water by a fine sand when water was supplied at both constant hydraulic potential and constant rate. The general behavior of the measured flux-concentration relations was found to be consistent with those of the model soils calculated by Philip. Within the accuracy of the measurements, no significant time-dependence of the relation was found for the constant flux boundary condition over a large time span. Measurements of the time-averaged flux-concentration relation, however, suggest some significant time-dependence for short times. Simple approximations for the flux-concentration relation, based on these observations, were suggested. These approximations enable easily evaluated predictions to be made of the salient features of constant rate application of water to soil, which are sufficiently accurate for most practical purposes. (See also W74-02464) (Sims-ISWS)
W80-03721

INFILTRATION OF SOILS AS AFFECTED BY THE PRESSURE AND WATER CONTENT AT THE TIME OF COMPACTION,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
M. Akram, and W. D. Kemper.
Soil Science Society of America Journal, Vol 43, No 6, p 1080-1086, November-December 1979. 20 Fig, 1 Tab, 7 Ref. AID/ta-C-1411.

Descriptors: *Infiltration, *Soil compaction, *Compacted soils, *Laboratory tests, Pressure, Moisture content, Cohesive soils, Soil types, Soils, Soil water, Bulk density, Freezing, Thawing, Wetting, Drying, Soil science, Volume reduction, Soil piping.

Infiltration rates, volume reduction, and bulk densities of soils were determined on soils as a function of compacting pressures and water content at the time of compaction. Maximum compaction generally occurred when the soils were packed at water contents near field capacity. When compacting loads were less than 1 kg/sq cm, the minimum bulk densities occurred when soils had water contents of about one-half field capacity, indicating that surface tension of water films in the soils plays a major role in cohesiveness and stabilization against compaction under these conditions. Compacting loads of 3.46 kg/sq cm, at field capacity on sandy loams and finer textured soils, reduced infiltration rates to less than 0.1% of values obtained after these soils had been compacted when they were air dry. In a loamy sand soil this reduction was to about 1%. The low infiltration rates following compaction were increased by wetting and drying, although several cycles of wetting and drying did not raise the infiltration rate to the level observed before packing. Freezing and thawing cycles also increased the infiltration rates of previously compacted soils. Most of the change took place in the first freezing and thawing cycle. The large changes in infiltration rates using achievable levels of compaction at the 'optimum' water contents indicate that compaction can play a major role in the management of water in ditches, reservoirs, furrows, and watersheds. (Sims-ISWS)
W80-03722

RECLAMATION OF SALINE-SODIC SOILS BY LEACHING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, W. M. Jarrell, and D. Devitt.
Soil Science Society of America Journal, Vol 43, No 6, p 1100-1106, November-December 1979. 8 Fig, 3 Tab, 16 Ref.

Descriptors: *Leaching, *Saline soils, *Alkaline soils, On-site investigations, Lysimeters, Cation exchange, Solutes, Land reclamation, Salts, Sodium, Chlorides, Magnesium, Irrigation, Soil chemistry, Soil chemical properties, Soil water, Soil types, Soil science.

Seven lysimeters containing sandy loam or clay loam soils were reclaimed by ponded or unsaturated leaching following a saline irrigation experiment of 2.5 years duration. Initial soil electrical conductivity was as high as 25 mmho/cm with associated exchangeable sodium percentages up to 60%. Substantial quantities of solid gypsum and lime were present in the soil profile from precipitation reactions during the crop irrigation stage. Drainage volumes were expressed in pore volume units to scale out differences between water retention and leaching rates. Plots of scaled chloride concentrations vs. pore volumes were similar for all lysimeters, with essentially all chloride removed by 1.5 pore volumes. Total salt removal was well described by a single curve for all treatments. Standard cation exchange equilibrium equations were used in a chromatographic displacement model to produce an algebraic equation to describe exchangeable Na reductions as a function of leaching pore volumes. This model, along with a model for calculating exchangeable Mg reductions, was in good agreement with measured changes for all treatments. No special amendments were required to maintain high permeability during leaching, even when distilled water was used, because of redissolution of previously precipitated Ca salts. (Sims-ISWS)
W80-03723

EFFECT OF TILLAGE ON SOIL-WATER MOVEMENT DURING CORN GROWTH,
Auburn Univ., Alabama. Dept. of Agronomy and Soils.
A. B. Weatherly, and J. H. Dane.
Soil Science Society of America Journal, Vol 43, No 6, p 1222-1225, November-December 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Soil water movement, *Cultivation, *Crops, *Corn(Field), *Alabama, On-site investigations, Soils, Soil types, Soil properties, Hardpan, Soil water, Soil moisture, Droughts, Bulk density, Root zone, Crop response, Crop production, Agriculture, Farm management.

The occurrence of drought during the growing season often limits the amount of soil water available for plant growth. The availability of soil water can further be limited if a hard layer exists not too far below the soil surface. Field experiments were therefore conducted on a Cahaba sandy loam soil (Typic Hapludult) to determine the effect of tillage practices on soil water movement during corn growth. Four tillage practices, namely, conventional-tillage-without-subsoiling, conventional-tillage-with subsoiling, no-tillage-without-subsoiling, and no-tillage-with-subsoiling, were studied on a soil with a plow plan. Soil water contents and soil water pressure heads were measured with a neutron probe and tensiometers, respectively. Water extraction by roots was determined by application of the integral form of the general transport equation for soil water. Soil water movement and water uptake were less for the conventional-tillage-without-subsoiling treatment than for the other treatments. The two subsoiled treatments and the no-tillage-without-subsoiling treatment indicated root penetration and soil-water uptake below 50 cm. When soil water uptake patterns were compared with corn yield on a weight-per-ear basis, there was a direct, positive correlation between the amount of water taken up by the corn plants and corn yield. (Sims-ISWS)
W80-03724

INFLUENCE OF A COMPACT ZONE ON SOLUTE TRANSPORT DURING INFILTRATION OF WATER,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
G. S. Hira, and N. T. Singh.
Soil Science Society of America Journal, Vol 43, No 6, p 1251-1252, November-December 1979. 3 Fig, 7 Ref.

Descriptors: *Infiltration, *Compacted soils, *Solutes, *Soil water movement, Soil water, Soils, Chlorides, Salts, Ions, Root zone, Bulk density, Soil physical properties, Soil science, Agriculture, Compact zone, Compacted layers.

In most soils, continuous plowing results in the formation of a compact zone below the plowing depth. Laboratory studies were conducted to examine the effect of such a zone on the displacement of chloride (Cl-) during infiltration of water. A compact zone of 4- or 8-cm thickness of 1.62 g/cu cm or 1.80 g/cu cm bulk density was created at a depth of 8 cm in soil columns. A surface-applied slug of calcium chloride was leached with 4 or 6 cm of distilled water. The presence of a compact zone in the soil profile pushed the Cl- peak deeper, dispersed the ions in a narrower region, and increased the peak Cl- concentration. Increasing bulk density and thickness of a compact zone increased the depth of the peak Cl- concentration. (Sims-ISWS)
W80-03727

HYDRAULIC CONDUCTIVITY OF MOUNTAIN SOILS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 2C.
W80-03775

2H. Lakes

FORMULATING LAKE MODELS WHICH PRESERVE SPECTRAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
C. Babajimopoulos, and K. W. Bedford.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15137, p 1-19, January 1980. 5 Fig, 30 Ref, 2 Append. OWRT B-063-OHIO(4).

Descriptors: *Hydrodynamics, *Lakes, *Mathematical models, Model studies, Numerical analysis, Turbulence, Turbulent flow, Hydrology, Equations, Statistical methods, Analytical techniques, Velocity, Distribution patterns, Water circulation, *Pollution controls, Signal processing, Digital filter.

The ability of numerical lake models to predict verifiable results is very poor. Difficulties with the popular point-by-point verification method are intractable when confronted with these turbulent flows which have only reproducible statistics. A lake transport model was formulated which permits the calculation of not only mean field quantities but the known spectral details of turbulent flow. Higher order spatial averaging of the non-Linear terms by a low pass filter results in a sequence of third order differential terms. Additionally, the correlated terms resulting from the filtration are closed with the Smagorinsky subgrid scale viscosity representation. Finite difference representations were used with second order accurate schemes on the third order corrective differential terms and fourth order on all others. Mean flow field computations were verified by intercomparison with existing rigid lid circulation models. Differences between computations were negligible with only small increases in time and storage. (Lee-ISWS)
W80-03605

FISH MORTALITY AND FISHING DURING AN UNPRECEDENTED DRAUGHT IN LAKE PICHHOLA, UDAIPUR,
Udaipur Univ. (India). Dept. of Zoology.
V. S. Durve, and V. K. Rajbanshi.
India Journal of Fisheries, Vol 22, p 297-299, 1975. 2 Fig, 1 Ref.

Descriptors: *Fishkills, *Lakes, *Droughts, *Dissolved oxygen, Water shortage, Moisture deficit, Climatology, Dry seasons, Commercial fish, Lake morphology, Lake stages, Water temperature, *India.

A heavy mortality of fish occurred in Lake Pichhola in Udaipur, in May 1973, due to an unprecedented draught. While most of the smaller-sized fishes were dead, the larger ones were fished out and marketed before the lake totally dried up. The method of fishing adopted is briefly described. Oxygen content was reduced to 2.3 ppn and water temperature was 35.9C. Fish were surfacing for oxygen & mortalities insued. (Deal-EIS)
W80-03698

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W80-03738

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03754

ANEROBIC METABOLISM OF IMMEDIATE METHANE PRECURSORS IN LAKE MENDOTA,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
For primary bibliographic entry see Field 5C.
W80-03812

MICROBIAL METHANOGENESIS AND ACETATE METABOLISM IN A MEROMICTIC LAKE,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
M. R. Winfrey, and J. G. Zeikus.
Applied and Environmental Microbiology, Vol 37, No 2, p 213-221, February, 1979. 5 Fig, 3 Tab, 27 Ref. NSF DEB 7824071 and DEB 73-01511-A01.

Descriptors: *Methane bacteria, *Metabolism, *Anaerobic conditions, *Microbial degradation, *Knaack Lake(WI), Water temperature, Anaerobic bacteria, Sediments, Microorganisms, Microbiology, Sediment-water interfaces, Carbon dioxide, Respiration, Depth, Meromixis, Nitrates, Sulfates, Water, Methane, Sulfides.

Methanogenesis in Knaack Lake, central Wisconsin, is highest in surface sediments (7.6 nmol CH4/10 ml h) at 22 m, considerably lower in deeper sediments (1.2 nmol CH4/10 ml h) and lowest in the water column (0.6 nmol CH4/10 ml h) at 21.5 m according to maximum rates calculated from 14-HCO3 reduction by endogenous electron donors. However, large dissolved methane concentrations (4,000 micro mol/l) occur in bottom waters and a maximum occurs 4 m above the sediment. Methane produced in the water column is of biological origin as no 14-CH4 is produced from 14C-labeled substrates in control experiments that contain formaldehyde. Temperature optimum for both methanogenesis from acetate and acetate respiration is 37C, characteristic of biological activity in nonthermophilic environments. Further experiments with 5 micro g sulfide/ml additions show methanogenesis stimulation from acetate, whereas the addition of higher concentrations inhibits methanogenesis. Acetate respiration is inhibited by 1.0 micro g sulfide/ml additions. Sulfate addition does not significantly inhibit methane production from acetate or increase acetate respiration from CO2. Nitrate addition, however, completely inhibits methanogenesis and slightly stimulates total 14-CO2 production. Knaack Lake is a small (1.1 ha) meromictic Lake with 22 m maximum depth. The lake is anaerobic below the thermocline (3 m) in the summer, mixes to 12-14 m during the fall, and is completely anaerobic under the ice in winter. (Danovich-Wisconsin)
W80-03813

A NINE-YEAR STUDY OF THE PHYTOPLANKTON OF THE EUTROPHIC AND NONSTRATIFYING LOCH LEVEN (KINROSS, SCOTLAND),
Institute of Terrestial Ecology, Edinburgh (Scotland). Plankton Ecology Project Group.
For primary bibliographic entry see Field 5C.
W80-03816

VERIFYING LAKE TRANSPORT MODELS WITH SPECIAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
K. W. Bedford, and C. Babajimopoulos.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15138, p 21-38, January 1980. 10 Fig, 2 Tab, 35 Ref. OWRT B-063-OHIO(5).

Descriptors: *Dispersion, *Hydrodynamics, *Lakes, *Mathematical models, Model studies, Turbulence, Energy, Winds, On-site investigations, Numerical analysis, Calibrations, Circulation, Limnology, Spectra, Energy spectra, Variance analysis, Verifying.

A sequence of numerical experiments was performed to determine the suitability of coarse grid lake turbulence models developed in the paper in preserving theoretically known variance spectra. A complete review of theoretically known variance spectra was presented, and all relevant spectral data from aquatic field experiments were summarized. Three basins were used and set into motion by a spectrally correct Markov model wind shear. Wave number spectra were calculated by Taylor's hypothesis from time series collected at the basin center. Based on these numerical experiments, it was concluded that low pass filter preparation is a necessity for coarse grid spectra preservation. Traditional model formulations will not reproduce the known spectra. Experiments revealed that the hydrostatic pressure assumption and rigid lid pressure formulation only permit a two-dimensional turbulence structure which is, of course, not observed in field data except during fluid acceleration. (Sims-ISWS)
W80-03836

ATTENUATION OF LIGHT AND DAILY INTEGRAL RATES OF PHOTOSYNTHESIS ATTAINED BY PLANKTONIC ALGAE,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
R. O. Megard, W. S. Combs, Jr., P. D. Smith, and A. S. Knoll.
Limnology and Oceanography, Vol 24, No 6, p 1038-1050, November 1979. 9 Fig, 3 Tab, 31 Ref. OWRT A-026-MINN(4).

Descriptors: *Photosynthesis, *Light, *Algae, *Plankton, Chlorophyll, Model studies, Mathematical models, Radiation, Irradiation, Equations, Theoretical analysis, Sampling, On-site investigations, Lakes, Organic matter, Attenuation, Limnology.

The daily integral rate of photosynthesis attained by planktonic algae in Lake Minnetonka, Minnesota, conforms to an equation for a rectangular hyperbola proposed by Bannister. The rate depends on the concentration of chlorophyll a in the mixed layer and also upon 2 kinetic parameters that are analogous to the kinetic constants in equations for reactions catalyzed by enzymes. One parameter is an upper limit, psi, that would be attained by very dense populations, and the other is a concentration of chlorophyll, c', at which attenuation of photosynthetically active radiation (PhAR) by the algae equals background attenuation by the water. The parameters were evaluated with the same statistical procedures used to evaluate the kinetic constants for enzyme reactions. The limit, psi, for the daily integral rate in this lake would be about 0.5 mol

02/m sq/d. Observed daily rates are usually less than 0.7 psi, because chlorophyll in the water usually intercepts less than 70% of the radiant energy. Coefficients for the attenuation of PhAR by chlorophyll, epsilon sub c, and by the water, epsilon sub w, were estimated from the linear regression of the total attenuation coefficient, epsilon, on chlorophyll concentration. The estimate of epsilon sub c is 0.022 + or - 0.005/m/mg Chl/m cu. Background attenuation, epsilon sub w, affects integral photosynthesis in the same way as a competitive inhibitor affects enzyme reactions: it is a constituent of c' = epsilon sub w/epsilon sub c which, together with chlorophyll concentration, determines the fraction of underwater PhAR intercepted by planktonic algae. (Sims-ISWS)
W80-03837

EARLY GROWTH OF PICEA SITCHENSIS (BONG.) CARR ON DEEP OLIGOTROPHIC PEAT IN NORTHERN IRELAND,
Ministry of Agriculture, Belfast (Northern Ireland).
For primary bibliographic entry see Field 2I.
W80-03863

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2I.
W80-03866

AGE, ORIGIN, AND PALAEO-ECOLOGICAL EVIDENCE OF BLANKET BOGS IN NORDTRONDELAG, NORWAY,
Trondheim Univ. (Sweden). Dept. of Botany.
For primary bibliographic entry see Field 2J.
W80-03868

PHOTOSYNTHETICALLY ACTIVE RADIATION IN A STAND OF PHRAGMITES COMMUNIS TRIN. II. MODEL OF LIGHT EXTINCTION IN THE STAND,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
Photosynthetica, Vol 7, No 1, p 50-57, 1973. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Marsh plants, *Energy conversion, *Model studies, Wetlands, Photosynthesis, Light intensity, Plant physiology, Primary productivity, Leaves, Structure.

A model of extinction of photosynthetically active radiation in a Phragmites stand is constructed on the basis of relative volume of shading (Vr) defined by the size of the plant aerial organs, their spatial distribution and by sun position. The suggested extinction law: R sub i = e to the (- sub i Vr) power (i = 1,2) is verified by experimental data and compared with other empirical formulae. Subscripts i specify the equation for extinction of both diffuse and direct radiation. (Steiner-Mass)
W80-03869

DIATOM FLORISTICS AND SUCCESSION IN A PEAT BOG NEAR LILY LAKE, SUMMIT COUNTY, UTAH,
Brigham Young Univ., Provo, UT. Dept. of Botany and Range Science.
S. A. Jatkar, S. R. Rushforth, and J. D. Brotherson.
Great Basin Naturalist, Vol 39, No 1, p 15-43, March, 1979. 8 Fig, 5 Tab, 43 Ref.

Descriptors: *Lake stages, *History, *Bogs, *Utah, Wetlands, Peat, Palynology, Succession, Lakes, Diatoms.

Diatoms from core samples obtained from the edge of Lily Lake, Summit County, Utah, were studied. Populations from each 15 cm of the core and niche metrics of the important species were analyzed. This study demonstrates four periods of history in the lake as mirrored by the diatom populations. The first period was mesotrophic and alkaline. This graded into an acidic, cystrophic period which in turn yielded again to a mesotrophic alkaline period. The most recent period can be characterized by a return to dystrophy. (Steiner-Mass)
W80-03872

PHYTOSOCIOLOGICAL STUDIES OF URYUNUMA MIRE STUDIES OF UPLAND BOG VEGETATION IN HOKKAIDO (II), (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Plant Ecology and Taxonomy.
For primary bibliographic entry see Field 2I.
W80-03874

OPTIMAL NICHE SPACE OF THE RED-WINGED BLACKBIRD (AGELAIUS PHOENICEUS), I. NESTING SUCCESS IN MARSH AND UPLAND HABITAT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03875

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2K.
W80-03893

2I. Water In Plants

HARPER SEEKS CLIMATE CONTROL WITH SPRINKLED VEGETABLES,
Arizona Farmer-Ranchman, p 12-15, August 1979. OWRT A-101-ARIZ(1), 14-34-0001-0103.

Descriptors: *Sprinkler irrigation, *Temperature control, *Soil temperature, *Vegetable crops, Irrigation efficiency, Arid climates, Arizona, Soil-water-plant relationships, Crop response, Evaporative cooling, Intermittent sprinkling, Water application.

Fred Harper and Dr. Arthur Pratt have been working on a 16-acre test with evaporative cooling via solid set sprinklers, west of Litchfield Park, Arizona, trying to get eight different vegetables to think they aren't being grown in Arizona summers where temperatures have been hitting 116 degrees. Harper and Pratt's work is designed to determine the effect of soil, filiage and fruit cooling through the use of sprinkler irrigation. They're also interested in determining whether water quality in terms of salt level has any adverse effect on plant growth and development when applied during high temperature periods. They want to know the effect of high humidity on pests and diseases; its effect on weeds; whether or not cooling growing conditions means better quality or eye appeal; and if cooling will allow growers to either extend their growing seasons further into the spring or plant earlier in the fall.
W80-03658

PHYTOMECHANICS--PLANT PHYSIOLOGY AND APPLIED MECHANICS,
Iowa State Univ., Ames.
D. B. Johnson, and C. P. Burger.
In: 'Developments in Theoretical and Applied Mechanics', Proceedings of 9th South Eastern Conference on Theoretical and Applied Mechanics, Vanderbilt Univ. Nashville, Tennessee, May 1978. Vol 9, p 553-562. OWRT B-062-IA (6), 14-34-0001-8086.

Descriptors: *Plant growth, *Plant physiology, *Growth rates, Soil-water-plant-relationships, Strain gage dendrograph, Dendromenter, Stress, Fatigue(Mechanics), Xylem, Water storage.

In plant physiology, the need for a simple, inexpensive, nondestructive method for continuously and accurately recording changes in stem diameters of woody plants has been recognized for nearly 100 years. A dendrograph which utilizes strain gages mounted directly on plant material appears to answer this need. Samples of data obtained with a strain gage dendrograph reveal that it is capable of recording complex dynamic changes in stem strain with an unprecedented degree of sensitivity.
W80-03780

CHEMICAL FLUCTUATIONS DUE TO SEASONAL AND CROPPING EFFECTS ON AN ALGAL-SEAGRASS COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
C. J. Dawes, K. Bird, M. Durako, R. Goddard, and W. Hoffman.
Aquatic Botany, Vol 6, No 1, p 79-86, January, 1979. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Benthic flora, *Tarpon Springs(FL), *Energy, *Plant growth, *Marine plants, Algae, Biomass, Energy conversion, Plant tissues, Plant physiology, Proteins, Marine algae, Primary productivity, Seasonal, Carbohydrates, Cutting management, Biochemistry, Growth rates.

Although total carbohydrate and protein levels vary between Thalassia and algal components in a seagrass bed off Tarpon Springs, Florida, 1977, final energy levels are roughly equal (4.2-4.3 kcal/g organic wt) for both components collected from plots before and after cropping or clearing. The seagrass bed is located 200 m offshore in one m of water at Sunset Park, Tarpon Springs on Florida's west coast. Highest protein levels occur in spring and range 3.2-10.6% for Thalassia (turtle grass) and 1.8-4.0% for algae. Protein levels are highest in regrowth collections from both totally cleared and cropped plots, suggesting protein synthesis during growth. Ash levels are 30-40% in turtle grass while algal ash levels are 60-70%. Ash levels are generally lower in turtle grass regrowth collections while algal regrowth has higher ash levels. No seasonal changes in ash content are evident for either component. Soluble carbohydrate levels are 3-12% for turtle grass and 6-10% for algae with highest levels in late spring and fall. Regrowth is very rapid in spring months and carbohydrate reserves can be replenished in four weeks. Results demonstrate that the algal component is energentically equal in importance to Thalassia. (Danovich-Wisconsin)
W80-03785

THE NUTRITIONAL ECOLOGY OF CYPERUS ESCULENTUS, AN EMERGENT AQUATIC PLANT, GROWN ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experimental Station, Vicksburg, MS. Environmental Lab.
J. W. Barko, and R. M. Smart.
Aquatic Botany, Vol 6, No 1, p 13-28, January, 1979. 5 Fig, 7 Tab, 33 Ref.

Descriptors: *Emergent plants, *Sediments, *Laboratory tests, *Nutrients, *Growth rates, Aquatic plants, Cultures, Nitrogen, Phosphorus, Limiting factors, Biomass, Organic matter, Nutrient requirements, Plant growth, Plant tissues, Soil chemistry, Sands, Bottom sediments, Rooted aquatic plants.

Nitrogen is growth-limiting for Cyperus esculentus, an emergent plant, grown in a greenhouse investigation with sediments obtained from Detroit River, Indiana Harbor, Michigan City Harbor, and Milwaukee Harbor. In sand cultures, Cyperus is similarly affected by selective removal of either nitrogen (N) or phosphorus (P). Shoot and tuber biomass directly correlate to both N and P supply. Critical concentration of N is 5.7 g/kg dwt and P is 0.95 g/kg dwt for Cyperus total biomass. Critical concentrations for shoots, tubers, and roots are 5.9, 5.2, 6.9 g/kg dwt, for N, respectively, and 0.79, 0.96, and 1.00 g/kg for P, respectively. Ratios of N:P are 7.5, 5.4, 6.9, and 6.0 for shoots, tubers, roots and total biomass, respectively. Sediments are predominatly fine textured but vary considerably in organic matter, P and N contents. Cyperus biomass ranges after three months growth on different sediments are substantial (0.6-18 kg/sq m). In general, shoot and tuber biomass are comparable at each site, and each exceeds root biomass. In

Cyperus both N and P are more concentrated in roots than in shoots and tubers. Tissue concentrations of N are less and P greater than the critical concentrations of these nutrients, suggesting that Cyperus growth is limited by N on most sediments used. Ratios of tissue N:P, when compated with sand culture values, substantiate N as the growth-limiting element. Ratios of belowground to aboveground biomass correlates negatively with plant growth. (Danovich-Wisconsin)
W80-03786

NITROGEN FIXATION BY THERMOPHILIC BLUE-GREEN ALGAE (CYANOBACTERIA): TEMPERATURE CHARACTERISTICS AND POTENTIAL USE IN BIOPHOTOLYSIS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 5F.
W80-03796

EXPERIMENTAL ECOLOGY WITH PARTICULAR REFERENCE TO PROPOSED COMMERCIAL HARVESTING OF DURVILLAEA (PHAEOPHYTA, DURVILLEALES) IN NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
C. H. Hay, and G. R. South.
Botanica Marina, Vol 22, No 7, p 431-436, October 1979. 5 Fig, 2 Tabb, 5 Ref.

Descriptors: *Plant growth, *Harvesting, *Colonization, *Phaeophyta, Ecology, Growth rates, Density, Littoral, Reproduction, Seasonal, Timing, Algae, Size, Weight, Methodology, Harvesting of algae, Biomass, Productivity, New Zealand, Durvillaea antarctica, Durvillaea willana.

Harvesting experiments on Durvillaea antarctica and D. willana, massive brown algae of lower littoral and upper sub-littoral rocky New Zealand coasts, respectively, show that year-round harvesting depletes standing stocks of both plants since harvesting time is critical in determining whether recolonization occurs the following season. Main study areas Tautuku and Kaikoura, localities 600 km apart on South Island east coast, were harvested 1972-1974. D. antarctica recolonization corresponds with the period of gamete release. Areas cleared April-June are recolonized by dense settlements: 7,000/sq m on Kaikoura and 1,400/sq m on Tautuku. Areas cleared after ganete release periods are poorly recolonized the following season (10/sq m) due to space competition with associated flora and invasion by other species. Although individual plant growth rates are highly variable, recolonizing D. antarctica stands are more uniform and compact than natural stands. Standing crops in experimental areas may be greater than in adjacent unmodified areas after 18 months. Harvesting methods are also important; removing holdfasts after harvesting causes dense recolonization and fast growth. Culling (removing only large fronds) increases small plant growth in the understory, but almost all those attached to composite holdfasts are later lost when holdfasts decay. Total reharvest of an area (Kaikours) culled 15 months previously is 32% of initial harvest. Whereas, 18 months regrowth on areas with removed holdfasts (Tautuku) weighs 1.5 times original wet weight. (Danovich-Wisconsin)
W80-03802

STREAM TYPES IN IDAHO: AN APPROACH TO CLASSIFICATION OF STREAMS IN NATURAL AREAS,
Idaho Univ., Moscow. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6B.
W80-03835

A NUTRITIONAL ANALYSIS OF A SUBLITTORAL DIATOM ASSEMBLAGE EPIPHYTIC ON ENTEROMORPHA FROM A LONG ISLAND SALT MARSH,
City Univ. of New York. Dept. of Biology.
J. J. Lee, M. E. McEnery, E. M. Kennedy, and H. Rubin.
Journal of Phycology, Vol 11, p 14-49, 1975. 97 Fig, 8 Tab, 80 Ref.

Descriptors: *Nutrient requirements, *Epiphytology, *New York, *Salt marshes, Wetlands, Biological communities, Marshes, Marine microorganisms, Marsh plants, Marine bacteria, Diatoms.

The diatom population structure of a salt marsh epiphytic community growing on Enteromorpha intestinalis was studied. A total of 218 species or varieties were recognized. The distribution of many species in the community was seasonal. Changes in the population structure of the community were reflected by changes in the nutritional patterns as judged by differences in the growth of diatoms and bacteria on different media. Almost half of the colony types grew on either unenriched seawater or basal synthetic seawater. Nitrite inhibited algal growth. Soil extract or acetone extract of Enteromorpha tripled growth; a complex vitamin extract mixture, glycerol, mannitol, or an autoclaved extract of Enteromorpha doubled colony numbers. The greatest number of diatom types and total colonies were recovered on media enriched with acetone extract of Enteromorpha, suggesting a possible nutritional relationship between Enteromorpha and its epiphytes. The algal assemblage growing epiphytically on Enteromorpha has a diverse auxotrophic profile which contributes to the productivity and stability within this important component of the epiphytic community and that much of the organic substrates used by individual species originate within and are recycled among the community members. (Steiner-Mass)
W80-03862

EARLY GROWTH OF PICEA SITCHENSIS (BONG.) CARR ON DEEP OLIGOTROPHIC PEAT IN NORTHERN IRELAND,
Ministry of Agriculture, Belfast (Northern Ireland).
D. A. Dickson, and P. S. Savill.
Forestry, Vol 47, No 1, p 57-88, 1974. 9 Fig, 25 Tab, 18 Ref.

Descriptors: *Peat, *Plant growth, *Nitrogen, *Trees, Wetlands, Bogs, Minerals, Potassium, Phosphorus, Softwood, Deficient elements, Fertilizers, Herbicides, Forest management.

Relationships were examined between growth of young Sitka spruce, planted on deep oligotrophic blanket peat, and uptake of N, P, and K by the trees under various fertilizer and herbicide regimes. Despite the provision of adequate P, tree growth eventually becomes limited by a shortage of available N. This can be overcome at present only by repeated applications of fertilizer N. The use of herbicides to kill heather in checked crops increases the availability of N temporarily, and fertilizer K in all situations improves growth, though often only slightly. It is suggested that following the initial application of phosphate a finite fraction of the total N content of the peat becomes available to the trees. Once this has been used the release of mineral nitrogen is so slow that crops become N-deficient and growth is limited. (Steiner-Mass)
W80-03863

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
W. J. Mitsch, and K. C. Ewel.
American Midland Naturalist, Vol 101, No 2, p 417-426, 1979. 2 Fig, 4 Tab, 21 Ref.

Descriptors: *Florida, *Swamps, *Plant growth, Wetlands, Biomass, Water pollution effects, Water levels, Environmental effects.

Lowest biomass and tree growth rates were found in cypress-pine associations indicative of low water, in monospecific stands of cypress that are indicative of high water levels, and in a poorly drained cypress dome. Increases in individual tree growth ranged from 1.0 to 3.5 kg/year in these groupings. Highest cypress tree growth rates were found in cypress-tupelo systems and cypress-hardwood systems. The latter are less dominated by cypress, however, so individual tree growth is greater. Cypress-hardwood associations are known to be generally better drained than cypress-tupelo systems. Two experimental cypress domes currently receiving treated sewage effluent and groundwater showed high individual tree growth (5.0 and 4.2 kg/year, respectively), but little difference was noted between the two domes. Tree diameter increase showed normal cypress tree growth to be 1.0-2.0 mm/year with higher values of 2.8-3.3 in cypress-hardwood associations and the experimental cypress dome. Cypress in the poorly-drained dome increased by only 2.0 mm/year. (Steiner-Mass)
W80-03866

A LOWLAND VEGETATION SEQUENCE IN SOUTH WESTLAND: PAKIHI BOG TO MIXED BEECH-PODOCARP FOREST. PART 1: THE PRINCIPAL STRATA,
Otago Univ., Dunedin (New Zealand). Dept. of Botany.
A. F. Mark, and P. M. F. Smith.
Proceedings of the New Zealand Ecological Society, Vol 22, p 76-92, 1975. 11 Fig, 2 Tab, 21 Ref.

Descriptors: *Bogs, *Forest, *Distribution patterns, Wetlands, Peat, Palynology, History, Vegetation, Biomass.

Six stands of lowland vegetation representing transitions from pakihi bog to mixed beech-podocarp forest are described quantitatively from the coastal plain of the Arawata and Jackson Rivers in South Westland. The sequence depicts progressive changes in canopy height, biomass and floristic richness, and appears to involve, at least in part, a primary succession. Some boundaries have been sharpened by periodic fires but the long-term trend remains unobscured. Pollen evidence indicates that the pakihi bog began as a lake when the surrounding area was forested by both podocarps and silver beech. The bog seems never to have supported a woody vegetation but in the absence of fire, forest would slowly encroach on it. With a highway traversing the sequence, its reservation for educational and scientific purposes has been proposed. (Steiner-Mass)
W80-03867

DISTRIBUTION OF MACROFAUNA ON A MALAYAN MANGROVE SHORE,
Malaya Univ., Kuala Lumpar (Malaysia). School of Biological Sciences.
A. Sasekumar.
Journal of Animal Ecology, Vol 43, No 1, p 51-69, February, 1974. 7 Fig, 5 Tab, 17 Ref.

Descriptors: *Mangrove swamps, *Distribution patterns, *Aquatic animals, Wetlands, Mollusks, Tidal effects, Swamps, Spatial distribution, Gastropods, Crabs, Environmental effects.

Environmental parameters and distribution of macrofauna in a Malayan mangrove shore were studied. The environment is characterized by plant cover, fine sediments with high water-contents, rich organic deposits and variable, often low salinity. Most of the mangrove shore is in the high tide range and is exposed to the air for over 90% of the time. The fauna consists predominantly of decapod crustaceans and gastropods with polychaetes in less variety but in significant numbers. The intertidal vertical range of a species is largely determined by tidal exposure time. Plankton feeders such as barnacles and oysters grow abundantly on the lower stems of trees (below high water of neap tides) on sea-facing edges where there is presumably a steady supply of plankton food. Other animals, including several species of polychaetes and grapsid crabs, occur in areas with over 90% exposure time. Considering the crabs, ten species of grapsids and five of ocypodids have successfully colonized the high shore, while ten species of ocypodids and three grapsids have remained at lower levels in streams and on the pioneer mangrove shore. Most gastropods occur in areas with over 90% exposure time. (Steiner-Mass)
W80-03870

THE ECOLOGY OF A SALTMARSH IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Botany.
M. A. Pemadasa, S. Balasubramaniam, H. G. Wijewansa, and L. Amarasinghe.
Journal of Ecology, Vol 67, No 1, p 41-63, 1979. 10 Fig, 1 Tab, 31 Ref.

Descriptors: *Salt marshes, *Ecology, *Ecological distribution, Wetlands, Marshes, Marsh plants, Distribution patterns, Environmental effects, Zoning, Topography, Tidal effects.

The ecology of a saltmarsh system on a small islet on the north-west coast of Sri Lanka was investigated, using association-analysis and reciprocal averaging to order the floristic and edaphic data. Six chief plant communities--thorn scrub, dry saltmarsh pasture, an Arthrocnemum consociation, Suaeda communities, damp saltmarsh pasture and depressions--were tentatively recognized, and their ecological and floristic distinctiveness and interrelationships were further elucidated by the multivariate analyses. The distribution within the saltmarsh system of some selected edaphic factors such as moisture regime, water-retaining capacity, textural properties, organic-matter content, pH, and calcium, carbonate and chloride concentrations was established. The zonation of the saltmarsh vegetation is discussed in relation to the individual and integrated effects of several ecological factors, of which topography, textural variations of the soil, and exposure to floods, tides and winds, appear to be of particular importance. (Steiner-Mass)
W80-03871

DIATOM FLORISTICS AND SUCCESSION IN A PEAT BOG NEAR LILY LAKE, SUMMIT COUNTY, UTAH,
Brigham Young Univ., Provo, UT. Dept. of Botany and Range Science.
For primary bibliographic entry see Field 2H.
W80-03872

PHYTOSOCIOLOGICAL STUDIES OF URYU-NUMA MIRE STUDIES OF UPLAND BOG VEGETATION IN HOKKAIDO (II), (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Plant Ecology and Taxonomy.
K. Ito, and A. Umezawa.
Japanese Journal of Ecology, Vol 23, No 1, p 1-22, February, 1973. 2 Fig, 12 Tab, 25 Ref. (English summary).

Descriptors: *Bogs, *Marsh plants, *Japan, Wetlands, Fens, Distribution patterns, Systematics, Classification.

A marsh plant community classification was made of the Uryu-Numa mires, Japan. In the classification, sociations are first distinguished by the dominant or constant species, or by a combination of them, with the habitat indicators. The sociations distinguished are then grouped into associations by the characteristic species or sometimes by their combination with the plants which are usually conspicuous physiognomically. Five associations were recognized: (1) Hydrophytic community (5 sociations), (2) Hygrophytic community (4 sociations), (3) Fen vegetation (4 sociations), (4) Moss vegetation (12 sociations), and (5) Substitute community (2 sociations). (Steiner-Mass)
W80-03874

OPTIMAL NICHE SPACE OF THE RED-WINGED BLACKBIRD (AGELAIUS PHOENICEUS), I. NESTING SUCCESS IN MARSH AND UPLAND HABITAT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
R. J. Robertson.
Canadian Journal of Zoology, Vol 50, p 247-263, 1972. 3 Fig, 6 Tab, 50 Ref.

Descriptors: *Nesting, *Non-game birds, *Marshes, Wetlands, Wildlife, Wildlife habitat, Water birds, Nests, Vegetation effects, Water levels.

Survival value of different parts of the fundamental niche of the redwinged blackbird was determined by comparing nesting success in marsh and upland habitats. Marsh nesting populations had greater success than those in uplands because of a smaller proportion of nests destroyed by predators. Predation pressure in marshes was negatively correlated with the depth of water beneath the nest, and the synchrony and density of nesting in marshes in some cases has a swamping effect on local predator populations. The structure and phenology of marsh compared with upland vegetation is an important factor in determining nesting density and synchrony. Growth rates of nestlings and weight at fledging are similar between habitats. Genetic separation between marsh and upland populations is unlikely. Territoriality probably results in a limitation to breeding density in both habitats. The results support the hypothesis that where sympatric, redwings are excluded from their optimal niche space by yellow-headed blackbirds. (Steiner-Mass)
W80-03875

FACTORS AFFECTING TISSUE NUTRIENT CONCENTRATIONS IN A SCIRPUS-EQUISETUM WETLAND,
McGill Univ., Montreal (Quebec). Dept. of Biology.
N. D. Auclair.
Ecology, Vol 60, No 2, p 337-348, 1979. 5 Fig, 6 Tab, 39 Ref.

Descriptors: *Distribution patterns, *Nutrients, *Wetlands, Canada, Marsh plants, Succession, Rooted aquatic plants, Potassium, Plant physiology, Plant tissues.

Potassium and nitrogen (12.0-23.5 mg/g) had the highest tissue concentrations followed by Ca Na P Mg. Micronutrient concentrations (Fe Mn Zn Cu) ranged from 0.003-0.532 mg/g. Macronutrients were 1.3-6 times and micronutrients 2-20 times greater than reported in Carex, Fagus, and Quercus dominated ecosystems. All elements except Cu, Na, and Zn had closely similar patterns of interspecies variation. Chelation, ion antagonism, and increased solubility of micronutrients in flooded soils were possible mechanisms accounting for the unique patterns of Cu, Na, and Zn accumulation. Equisetum fluviatile had the highest level of total nutrients in green tissue. This was over twice that in Phragmite communis which had the lowest level. Element concentrations were 22.3% higher in pioneer species and 21.9% lower in mature species when compared to the community average. Edaphic parameters were 4 to 5 times more important than community structural attributes in varying tissue element concentrations. Among soil elements, potassium had the highest correlation with tissue P, K, Ca, and Mg concentration. Soil calcium had the highest correlation with tissue nitrogen and the micronutrients Cu, Fe, and Mn. (Steiner-Mass)
W80-03876

STRUCTURE OF MANGROVE FORESTS IN FLORIDA, PUERTO RICO, MEXICO, AND COSTA RICA,
Puerto Rico Dept. of Natural Resources, San Juan.
D. J. Pool, S. C. Snedaker, and A. E. Lugo.
Biotropica, Vol 9, No 3, p 195-212, 1977. 12 Fig, 5 Tab, 22 Ref.

Descriptors: *Plant morphology, *Mangrove swamps, Wetlands, Trees, Density, Height, Plant growth.

Structural parameters of mangrove forests were measured at seven geographical locations in Florida, Puerto Rico, Mexico, and Costa Rica. The largest basal area and most structurally developed mangrove forests were the riverine forests of the Atlantic coast of Costa Rica and the Marismas Nacionales, Mexico. The smallest basal area was measured for the dwarf mangroves in southeastern Florida and the fringe mangrove on the dry coast of Puerto Rico. Riverine and basin mangrove types had taller canopies than the scrub, fringe, and overwash types. Stand densities were greatest for the fringe forest at Jobos Bay, Puerto Rico and for the dwarf forest or scrub mangroves in Florida. No individual trees greater than 10 cm DBH were reported for either of these sites. Complexity indices ranged from 0.9 (Punta Gorda, Puerto Rico) to 97.5 (Jobos Bay, Puerto Rico). (Steiner-Mass)
W80-03879

COMPARISON OF THE ASSEMBLAGES OF SAP-FEEDING INSECTS (HOMOPTERA-HEMIPTERA) INHABITING TWO STRUCTURALLY DIFFERENT SALT MARSH GRASSES IN THE GENUS SPARTINA,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Entomology and Economic Zoology.
R. F. Denno.
Environmental Entomology, Vol 6, No 3, p 359-372, June, 1977. 12 Fig, 40 Ref.

Descriptors: *Biological communities, *Insects, *Marsh plants, *Salt marshes, Habitat, Wetlands, Marsh management, Marshes, New Jersey, Grasses, Distribution patterns, Spatial distribution.

The vegetation of New Jersey tidal salt marshes is composed primarily of 2 grasses; Spartina patens, which occupies a narrow elevational zone of high marsh and Spartina alterniflora, an intertidal species. S. patens forms a dense, persistent, thatch, while S. alterniflora produces only a loose lattice of litter which rapidly decomposes. A comparison between the guilds of sap-feeding insects (for the most part, Delphacidae, Cicadellidae, Issidae, and Miridae) inhabiting these grasses reveals S. patens housing a much more diverse assemblage of herbivores than S. alterniflora. S. alterniflora-inhabiting species are exclusively bi- or trivoltine, while on S. patens, sap-feeders possess a greater variety of life history types and show a specialized trend toward univoltinism. Removal of only the dead thatch portion of S. patens results in reduced species diversity and evenness of sap-feeders on the living grass system. Trivoltine species, which normally inhabit the upper strata of S. patens, increase their populations on dethatched grass compared to the unaltered grass system. Both empirical and experimental evidence suggests that the complex microstructure and thatch of S. patens provide a more heterogeneous and protective resource which supports a more diverse and specialized fauna of sap-feeders than S. alterniflora. (Steiner-Mass)
W80-03881

PATTERN AND DIVERSITY IN SWAMP AND DUNE VEGETATION, NORTH STRADBROKE ISLAND,
Queensland Univ., Brisbane (Australia). Dept. of Botany.
W. E. Westman.
Australian Journal of Botany, Vol 23, No 2, p 339-354, 1975. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Distribution patterns, *Marsh plants, *Dunes, Wetlands, Spatial distribution, Swamps, Grasslands, Competition.

The pattern of plant species distribution, species richness, the distribution of resources among species, and the manner of change of these parameters are examined in the closed-heath vegetation of a freshwater swamp, the grassland and low closed-forest of a frontal low dune sequence and the closed sclerophyllous forests of inland high dunes. The floristic diversity and complexity of spatial patterning within a small area is highest in the freshwater swamp vegetation. The complexity of the swamp vegetation is enhanced by a remarkable high species richness, a very low concentration of dominance and a high degree of intermingling of species. The swamp vegetation appears to have undergone a high degree of speciation; at the same time, intermixture of species and the small scale of patterning have served as a means of minimizing intraspecific competition. (Steiner-Mass)
W80-03882

2J. Erosion and Sedimentation

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental

Quality Lab.
For primary bibliographic entry see Field 7C.
W80-03613

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
For primary bibliographic entry see Field 8B.
W80-03620

A REEXAMINATION OF BAGNOLD'S GRANULAR-FLUID MODEL AND BED LOAD TRANSPORT EQUATION,
Scripps Institution of Oceanography, La Jolla, CA.
J. A. Bailard, and D. L. Inman.
Journal of Geophysical Research, Vol 84, No C12, p 7827-7833, December 20, 1979. 6 Fig, 13 Ref.

Descriptors: *Bed load, *Sediment transport, *Model studies, Mathematical models, Flow, Streamflow, Stress, Energy, Sediments, Sands, Rivers, Beds under water, Sedimentology, Bed load transport.

Bagnold's bed load transport model was reexamined by using only the momentum equation, the Coulomb yield criteria, and the definition of the rate of energy dissipation for a shearing fluid. The general form of Bagnold's bed load equation was rederived but with two specific differences: Coulomb's yield criteria, tan phi = T/P, holds only at the interface between regions of shearing and non-shearing grains, and the ratio of the mean to maximum granular velocity enters as an additional factor. (Sims-ISWS)
W80-03625

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
J. K. Cochran, and R. C. Aller.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 739-747, December 1979. 5 Fig, 1 Tab, 21 Ref. NOAA 04-4-022-35.

Descriptors: *Sediments, *Cores, *Radioisotopes, *Benthic fauna, Sampling, Data collections, On-site investigations, Coasts, Sludge disposal, Sewage sludge, Water pollution, Uranium radioisotopes, Lead radioisotopes, Sedimentation, Sedimentation rates, Sedimentology, *New York Bight, Thorium radioisotopes.

Two diver-collected cores of mud-rich sediment from the New York Bight apex were analyzed for 238U and 232Th decay series nuclides with emphasis on 234Th/238U disequilibrium. Excess 234Th was present in both cores and showed exponential decrease in the top 4 cm. Biogenic reworking by a deposit-feeding community characterized by a Nucula proxima-Nephtys incisa assemblage apparently controls the form of the 234Th profiles. Mixing coefficients of 0.0000003-0.0000006 sq cm/s were calculated. No decrease of 210Pb with depth (0-11 cm) was found nor was there any vertical structure in profiles of 228Th. Episodic deposition followed by periods of stability cause the observed homogeneity of the longer lived nuclides as well as laminated horizons in the sediment. 234U/238U isotope ratios reflect addition of either seawater or sewage source uranium to the collection area. (Sims-ISWS)
W80-03629

SUSPENDED MATERIAL DISTRIBUTIONS IN THE WAKE OF ESTUARINE CHANNEL DREDGING OPERATIONS,
Connecticut Univ., Groton. Marine Sciences Inst.
W. F. Bohlen, D. F. Cundy, and J. M. Tramontano.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 699-711, December 1979. 8 Fig, 1 Tab, 11 Ref. ONR N00140-77-C-6536.

Descriptors: *Dredging, *Suspended solids, *Sediments, Rivers, Estuaries, Sediment transport, Particle size, Carbon, Turbidity, Water pollution, Storms, Streamflow, On-site investigations, Sampling, Temperature, Water temperature, Salinity, Coasts, Tidal waters, Connecticut, *Thames River(CT).

Field sampling of the suspended material field downstream of a large volume bucket dredge operating in the Lower Thames River estuary near New London, Connecticut, was conducted in order to examine the magnitude and character of the dredge-induced resuspension and to evaluate typical operational efficiency. These data indicated that approximately 1.5 to 3% of the sediment volume in each bucket-load is introduced into the water column producing suspended material concentrations adjacent to the dredge of 200 mg/l to 400 mg/l. These values exceeded background levels by two orders of magnitude. Analysis of particulate organic carbon and grain size characteristics indicated that resuspension also alters suspended load composition increasing the percentage of inorganic materials and median grain size. Proceeding downstream, material concentrations along the centerline of the dredge-induced plume decrease rapidly approaching background within approximately 700 m. Compositional variations display similar trends with the major perturbations confined to the area within 300 m of the dredge. The observed spatial distributions indicated that the dredge-induced resuspension is primarily a near field phenomenon producing relatively minor variations as compared to those caused by naturally occurring storm events. Previous work has shown that these latter systems can produce estuary-wide variations in suspended material concentrations, increasing the mass of material in suspension by at least a factor of two. This increase in total suspended load is nearly an order of magnitude larger than that produced by the dredge. (Sims-ISWS)
W80-03631

SURF ZONE DYNAMICS DURING UPWELLING ON THE OREGON COAST,
Williams Coll., Williamstown, MA. Dept. of Geology.
For primary bibliographic entry see Field 2L.
W80-03632

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. K. Sunday.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152044, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, 1979. 107 p, 61 Fig, 13 Tab, 17 Ref, Append. OWRT B-170-COLO(1), 14-34-0001-8067.

Descriptors: Salinity, Water quality, Sediment, Channel behavior, Runoff conductivity, *Rill development simulation, *Sediment yield, Dissolved solids, Mancos shale, *Salt yield, Watershed, *Runoff, Slope, Colorado River Basin.

Field studies of salinity in runoff were conducted by applying runoff directly to the hillslope through a perforated pipe and, secondly, by rainfall simulation to produce runoff. Average electroconductivity (EC), a measure of total dissolved solids, was found to increase with increasing values of slope and after rilling of the hillslope. Rill development and flow velocities are further investigated since both are shown to be significant factors in high salt loads in runoff. Rill development is studied by computer simulation. The generated rill patterns are shown to be comparable to drainage systems measured in the field by Horton (1945). They also show characteristics similar to rill patterns generated in laboratory experiments by Mosley (1972). The results show that slope has a significant effect on the rill patterns as documented by geomorphologists (Zernitz, 1932; Howard, 1967). Keeping the sources fixed, the length of rills produced was shown to vary with slope and cross-slope and total rill length has been shown to be a factor in high sediment yields (Mosley, 1972). The computer simulation is shown to provide considerable promise for further studies of the relationships of geomorphic variables. A laboratory control situation was designed to isolate the effects of: (1) increased flow velocities; (2) different layers of Mancos shale (unweathered and weathered); and (3) particle size of shale. Linear relationships between electroconductivity and increasing flow velocities are provided. Further laboratory results indicated that for the same flow velocity, unweathered Mancos shale yields approximately twice as much salt to the flow as weathered Mancos shale if the two have a comparable size range (exposed surface area). Flow over large sizes of unweathered Mancos shale is shown to give slightly lower values of salinity compared to the weathered Mancos shale in the smaller size range.
W80-03643

SEDIMENTS SUSPENDED IN STREAM FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
S. M. Antsyferov, and R. D. Kos'yan.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15216, p 313-330, February 1980. 4 Fig, 1 Tab, 37 Ref, 2 Append.

Descriptors: *Sediments, *Suspended solids, *Diffusion, *Streamflow, Velocity, Suspension, Sediment transport, Model studies, Mathematical models, Laboratory tests, Equations, Mathematics, Sedimentology.

This paper considered a stationary translational sediment carrying flow. Correlation with experimental data enabled one to single out reliable solutions from a number of 'traditional' ones which were based on the concept of equality of moment transfer and sediment diffusion coefficients. By making use of energy considerations it became possible to delineate the area of applicability of the traditional diffusion model. An empirical expression was proposed to describe the distribution of concentration in the near-bottom region. The combination of the singled-out solution of the diffusion model with this empirical relationship allowed one to compile an expression describing the distribution of concentration over the entire depth of the flow, and to offer a suitable calculation procedure. (Sims-ISWS)
W80-03718

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
J. M. Laflen, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 43, No 6, p 1213-1215, November-December 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Soil erosion, *Crops, *Soybeans, *Corn(Field), On-site investigations, Runoff, Suspended solids, Dissolved solids, Sediments, Sediment yield, Rainfall, Water loss, Agriculture, Erosion control, Soil science.

Many people have observed what they felt was greater soil erosion by wind and water following production of soybeans. This experiment was conducted to measure the actual erosion following soybean production compared to that following corn production. Using natural rainfall plots at Beaconfield, Iowa, soil and water losses were measured from soybeans in a corn-soybean rotation and from corn in this same rotation and grown continuously over a 7-year period. Soil losses were found to be greater following soybeans than following corn in either a corn-soybean rotation or in continuous corn. This means more precautions must be taken to control erosion when soybeans are grown on sloping lands than when corn is grown. (Sims-ISWS)
W80-03725

RECENT GEOCHEMICAL HISTORY OF FLOOD DEPOSITS IN THE NORTHERN CHESAPEAKE BAY,
State Univ. of New York at Stony Brook. Marine

Sciences Research Center.
D. J. Hirschberg, and J. R. Schubel.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 771-784, December 1979. 8 Fig, 26 Ref, 1 Append. NSF OCE7809645.

Descriptors: *Floods, *Sedimentation rates, *Estuaries, *Chesapeake Bay, Radioisotopes, Radioactive dating, Sediments, Geochemistry, Sampling, Cores, Data processing, X-rays, X-ray analysis, Sedimentation, Sedimentology.

210Pb and 137Cs dating of sediment cores from the extreme northern Chesapeake Bay has revealed that episodic sedimentation events associated with Susquehanna River floods in 1936 and 1972 have contributed half of all sediment deposited in this area since 1900. Much of this sediment was derived from resuspension of sediment trapped along the riverbed during years of normal riverflow. The normal 210Pb determined sedimentation rate in this region, excluding flood events, was 0.45 cm/year which is in good agreement with rates previously estimated from sediment budget models. The long term sedimentation rate is probably twice this value which is in agreement with drainage basin sediment yield and denudation rate studies. (Sims-ISWS)
W80-03735

EROSIONAL ASPECTS OF MANAGING URBAN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., J. M. DiLouie, Jr., and T. S. Pytlar, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153422, Price codes: A05 in paper copy, A01 in microfiche. Completion report, January 1980, 76 p, 27 Fig. OWRT B-067-NJ(2), 14-34-0001-8100.

Descriptors: Engineering strucrtures, Channels, *Channel morphology, *Erosion control, Bank stability, *Erosion, Floods, *Stream stabilization, *Urban runoff, Urban drainage, *Urbanization, *Storm runoff, *Culverts, Channel erosion, Channel improvement, *Environmental effects.

The erosional aspects of streams in urbanizing areas were investigated by correlating land use information and physical data on a number of New Jersey streams and by modeling process based upon sediment transport therory. It was concluded (1) that processes of urbanization, by means of increasing rates of runoff, greatly increased bedload capacity and hence erosive capability of streams, (2) that urbanizing streams are vulnerable to channel degradation and increased bank erosion, (3) that in such cases culverts at road crossings which create a retarding effect upon flood flows have a beneficial effect, both in reducing flood peaks downstream and in reducing channel erosion potential, and (4) that in urbanizing areas, an integrated approach appears desirable, including desing of detention basins, design of culverts at road crossings, use of energy dissipating structures, and a program of land use control.
W80-03773

AN EMPIRICAL MODEL FOR PHYSICAL PARAMETERS OF RECENT SEDIMENTARY DEPOSITS OF LAKE EKOLN AND LAKE VANERN,
National Swedish Protection Board, Uppsala.
For primary bibliographic entry see Field 5A.
W80-03790

HOLOCENE SEDIMENTATION AT CAPE SABLE, SOUTH FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, T. Whelan, and W. G. Smith.
Sedimentary Geology, Vol 18, p 25-60, 1977. 21 Fig, 4 Tab, 22 Ref.

Descriptors: *Intertidal zone, *Sedimentation, *Florida, Wetlands, Mud flats, Sediments, Shores, Beaches, Mangrove swamps.

A regionally distinct mosaic of sedimentary environments including beaches and beach ridges which formed under relatively high-energy conditions through low-energy, tide-dominated environments to quiescent inland lakes and ponds, exists at Cape Sable, south Florida. Environments of deposition from the sandy capes inland are: shell beaches and beach ridges, black mangrove mudflats, ponded mudflats, exposed mudflats, Lake Ingraham, coastal levees and supratidal plain, and ephemeral ponds. With exception of the beaches and beach ridges, sediments of the other environments are dominantly calcareous muds and silts and represent a depositional history related to frequency of tidal inundation and storms. Cores through the supratidal plain reveal a basal carbonate-mud sequence much like subtidal elements of modern Florida Bay. This unit has a typical marine carbonate-mineral suite, numerous shallow-marine molluscs, and an abundance of Thalassia root burrows. An intermediate intertidal unit characterized by marine-brackish carbonate sediments with algal laminations is overlain by massive aragonitic supratidal silts and silty clays. The entire sequence is capped by a dark, highly organic zone representative of the coastal levee and intervening algal-flat sediments. (Steiner-Mass)
W80-03864

LANGEBAAN LAGOON: A MIXED CARBONATE-SILICICLASTIC TIDAL ENVIRONMENT IN A SEMI-ARID CLIMATE,
Cape Town Univ. (South Africa). Marine Geoscience Unit.
B. W. Flemming.
Sedimentary Geology, Vol 18, p 61-95, 1977. 22 Fig, 1 Tab, 36 Ref.

Descriptors: *Sediment distribution, *Lagoon, Wetlands, Tidal effects, Mudflats, Hydraulics, Salt marshes, Sedimentation, Sediments.

Langebaan lagoon divides physiographically into a north-south sequence following the modern energy gradient. In contrast, sediment distribution is east-west aligned, dividing the lagoon into two major provinces that reflect a different, relict energy regime. The sediments consist predominately of a quartz-carbonate mixture. Both sedimentary components are in hydraulic equilibrium although concentration levels are diametrically opposed. The carbonate content decreases over 40% in the north to less than 5% in the south. The differential concentration is explained by selective separation of the carbonate component during the transportation phase of the sediment. The modern sand banks and intertidal flats are underlain by large fossil oyster reefs dating between 6,000 and 2,000 years B.P. Primary sedimentary structures are environmentally sensitive. Large underwater dunes occur in the channels. The upper intertidal flats, close to the lagoonal beaches are characterized by a distinct association of primary structures. (Steiner-Mass)
W80-03865

AGE, ORIGIN, AND PALAEO-ECOLOGICAL EVIDENCE OF BLANKET BOGS IN NORD-TRONDELAG, NORWAY,
Trondheim Univ. (Sweden). Dept. of Botany.
U. Hafsten, and T. Solem.
Boreas, Vol 5, p 119-141, 1976. 9 Fig, 1 Tab, 25 Ref, 2 Append.

Descriptors: *Bogs, *Stratigraphy, *History, Wetlands, Peat, Palynology, Geologic time, Soil profiles, Pollen, Fens, Succession, Palaeoclimatology.

Pollen diagrams, C14-datings, and peat stratigraphy are presented from three sides in the Forradal sub-oceanic area in Nord-Trondelag, a moorland complex of flat and sloping fens and blanket bogs. The vegetational and climatic history during the last 8500 years is described, together with a survey of present-day conditions. This origin of the blanket-bog areas is shown to agree generally in both time and mode of genesis, with similar bog types in Scotland and northern England. Dates are given for the expansion of both alder and spruce, the latter occurring more than 1000 years later than in southeastern Norway. The possible role of provenance formation and Roman Iron Age amelioration of the climate is discussed in this connection. The course of the alder pollen curve indicates a drier and probably colder type of climate about 3000-2400 B.C. (Steiner-Mass)
W80-03868

2K. Chemical Processes

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, II. GEOCHEMICAL CYCLING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 2L.
W80-03630

GEOLOGY AND GEOCHEMISTRY OF ARSENIC, ESTER DOME AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. B. Hawkins, R. B. Forbes, C. I. Hok, and D. Dinkel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153232, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-5, January 1980. 7 p. OWRT B-037-ALAS(1), 14-34-0001-8056.

Descriptors: Public health, Water, Domestic water, Potable water, *Arsenic, Gold, *Subsurface waters, Surface water, Alaska, *Path of pollutants, *Geologic mapping, *Ester Dome area(Alaska).

Geologic mapping of the Ester Dome area more clearly defined the previously recognized mineralized region there. Analyses of well cuttings from domestic wells show that the rocks in which some of the wells are drilled are enriched in arsenic and serve as an immediate source of arsenic to the groundwater flowing into the well. The primary source of arsenic in the waters is this arsenic-bearing sulfide mineralization. Stream sediments near mineralized areas tend to be enriched in arsenic, suggesting this analysis of stream sediments might be useful for geochemical prospecting for sulfide minerals and the accompanying gold mineralization. Garden vegetables grown with arsenic-enriched water tend to become somewhat enriched in arsenic, but a much greater health hazard comes from drinking this water.
W80-03712

RECLAMATION OF SALINE-SODIC SOILS BY LEACHING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W80-03723

MIXING MODELS AND IONIC GEOTHERMOMETERS APPLIED TO WARM (UP TO 60C) SPRINGS: JORDAN RIFT VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
E. Mazor, D. Levitte, A. H. Truesdell, J. Healy, and A. Nissenbaum.
Journal of Hydrology, Vol 45, No 1/2, p 1-19, January 1980. 12 Fig, 2 Tab, 14 Ref.

Descriptors: *Mixing, *Model studies, *Geothermal studies, *Thermal springs, *Geochemistry, Springs, Aquifers, Stable isotopes, Thermometers, Groundwater recharge, Gases, Meteoric water, Sampling, Silica, *Israel, *Geothermometers, *Noble gases, Ionic ratios.

Mixing models and evaluation of Si02 contents of warm-water manifestations in the Jordan-Dead Sea Rift Valley indicate that these waters are fed by aquifers with estimated temperatures of up to 68C. These calculations and Na/K ratios; concentrations of Na, K, and Ca; concentrations of atmospheric Ne, Ar, Kr, and Xe; and concentrations of the stable hydrogen and oxygen isotopes all indicate below-boiling temperatures. No indications are available for the existence of above-boiling geothermal systems in the Jordan Rift Valley. Slightly higher than observed temperatures are concluded for a deep component at the springs of

Hammat Gader (67C), Gofra (68C), the Russian Garden (40C), and the Yesha well (53-65C). These temperatures may encourage further developments for spas and bathing installations and, to a limited extent, for space heating, but are not favorable for geothermal power generation. (Visocky-ISWS)
W80-03728

KINETICS OF CHEMICAL PROCESSES IN A CARBONATE AQUIFER: A CASE STUDY OF WATER-ROCK INTERACTION IN THE AQUIFER OF WESTERN AND CENTRAL GALILEE (ISRAEL),
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
A. Nadler, M. Magaritz, F. Mazor, and U. Kafri.
Journal of Hydrology, Vol 45, No 1/2, p 39-56, January 1980. 5 Fig, 7 Tab, 27 Ref.

Descriptors: *Kinetics, *Carbonate rocks, *Aquifers, *Chemical reactions, *Water chemistry, Geochemistry, Geologic control, Groundwater movement, Dolomite, Chemical analysis, Sampling, Retention, Bicarbonates, Alkalinity, Saline water, *Water-rock interaction, *Chemical processes, *Israel, Ionic ratios.

The origin of ions in the groundwater of the western and central Galilee (W.C.G.) aquifer is attributed to the dissolution of carbonate rock. Similar chemical compositions have been obtained in laboratory experiments that simulated natural conditions. The field and experimental data indicate the time dependency of ionic composition. A linear correlation was found between the Mg(2+) concentration and the aquifer decay time. The kinetic factors of the W.C.G. groundwater were found to resemble other carbonate-aquifer waters, e.g., in Pennsylvania and Virginia. (Visocky-ISWS)
W80-03730

HYDROCHEMISTRY OF DISSOLVED INORGANIC CARBON IN THE ST. LAWRENCE ESTUARY (CANADA),
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W80-03736

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
For primary bibliographic entry see Field 5F.
W80-03892

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
H. de Haan.
Limnology and Oceanography, Vol 22, No 1, p 38-44, January 1977. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Micerobial degradation, *Tjeukemeer(The Netherlands), Netherlands, *Acids, *Molecular structure, Microbiology, Microorganisms, Cultures, Size, Growth rates, Bacteria, Fluorescence, Metabolism, Arthrobacter, Sewage effluent, Humic acids, Ecology, Distribution, Absorption.

Microbial processes as well as hydrology may play a role in seasonal fluctuations in fulvic acid molecular size distribution in Tjeukemeer, The Netherlands. Results of media gel filtration containing fulvic acid clearly demonstrate that Arthrobacter microorganisms from Tjeukemeer affect molecular size distribution of fulvic acids. Moreover, the elution pattern before and after Arthrobacter growth on concentrated lake water to which benzoate had been added shows that fulvic acid fraction II is dependent on microbial activity. Benzoic acid additions affect both bacterial growth and color changes in incubated Tjeukemeer water; flourescence also significantly decreases. The observed effects indicate benzoate stimulation of fulvic acid microbial decomposition. Benzoate has a priming effect; it enhances the slowly proceeding decomposition process by actively metabolizing microbes. Although Arthrobacter cell yield on fulvic acid alone is 25 micro g/ml, benzoic acid additions to fulvic acid medium increases cell yield to 100 micro g/ml. The medium Sephadex elution pattern is affected by growing Arthrobacter cells. Before growth the medium contains fulvic acid fraction FI and benzoate. After growth benzoate disappears and a second fulvic acid fraction FII appears. Fraction FII, formed during Arthrobacter growth, is a FI derivative of relatively smaller size. (Danovich-Wisconsin)
W80-03893

2L. Estuaries

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
For primary bibliographic entry see Field 2E.
W80-03619

SUBMARINE SLIDE-GENERATED WATER WAVES IN KITIMAT INLET, BRITISH COLUMBIA,
Institute of Ocean Sciences, Sidney (British Columbia).
T. S. Murty.
Journal of Geophysical Research, Vol 84, No C12, p 7777-7779, December 20, 1979. 2 Fig, 14 Ref.

Descriptors: *Landslides, *Inlets(Waterways), *Waves(Water), On-site investigations, Mathematical models, Coasts, Shores, Bays, Estuaries, Canada, *Submarine slides, *Kitimat Inlet(British Columbia).

A major submarine slide occurred on April 27, 1975, in Kitimat Inlet in the Douglas Channel system on the west coast of Canada. Following this slide at least two water waves were observed, and it was estimated that the range (crest plus trough) of the first wave could have been 8.2 m. Two simple theories were used here to estimate the wave height. By considering the uncertainties both in the observed data as well as in the calculated wave height, there was reasonable agreement. (Sims-ISWS)
W80-03627

SOME ASPECTS OF THE OCEANOGRAPHY OF THE GULF OF MEXICO USING SATELLITE AND IN SITU DATA,
Research Triangle Inst., Research Triangle Park, NC.
F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King.
Journal of Geophysical Research, Vol 84, No C12, p 7749-7768, December 20, 1979. 12 Fig, 5 Tab, 21 Ref. DOE EG-77-C-05-5444.

Descriptors: *Oceanography, *Gulf of Mexico, *Remote sensing, Satellites(Artificial), On-site investigations, Currents(Water), Ocean currents, Meanders, Circulation, Ocean circulation, Water circulation, Water temperature, Infrared radiation, Loop Current(Gulf of Mexico).

Satellite infrared data and in situ data were combined to study synoptic-scale and mesoscale fronts in the Gulf of Mexico in the period 1973-1977. Deep northward penetrations of the Loop Current were noted in the winter, and a major warm gyre developed in the winter, 1974. Other major warm gyres were seen to develop in the early spring (1974 and 1977). In all cases, a very large meander developed off the southern part of the west Florida shelf prior to the development of the major warm gyre. Smaller meanders were seen to move along the Loop Current boundary at an average speed of 28 km/day and with an average wavelength of 210 km. (Sims-ISWS)
W80-03628

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-03629

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, II. GEOCHEMICAL CYCLING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, R. Wollast, and G. Billen.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 727-738, December 1979. 9 Fig, 19 Ref.

Descriptors: *Manganese, *Estuaries, *Rivers, Sampling, On-site investigations, On-site data collections, Chemical analysis, Chemicals, Suspended solids, Dissolved solids, Salinity, Hydrogen ion concentration, Oxidation-reduction potential, Geochemistry, Sediments, Coasts, Oceans, Oceanography, Water chemistry, *North Sea coast, *Rhine Estuary, *Scheldt Estuary.

Measurements of dissolved and particulate suspended Mn concentrations throughout the Rhine and Scheldt estuaries were interpreted in terms of cycling processes of Mn. Dissolved Mn is removed in the lower estuary into particulate form. This gives rise to elevated Mn concentrations in coastal suspended matter; particulate Mn is also partially returned to the upper estuary by estuarine circulation processes. Dissolved Mn is produced in the upper estuary by dissolution of particulate Mn either in the water column owing to the low pH and Eh prevailing at low salinities or in the anoxic sediments, from where it subsequently diffuses into the overlying water. Budget calculations and other arguments showed that a significant part of the Mn carried down by the river is recycled between the lower and upper estuaries. An important part accumulates within the sediments; the fraction that escapes to the marine environment is mainly in particulate form. Very similar conclusions can be drawn for the two estuaries with quite different residence times of both water and particulates. (Sims-ISWS)
W80-03630

SUSPENDED MATERIAL DISTRIBUTIONS IN THE WAKE OF ESTUARINE CHANNEL DREDGING OPERATIONS,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 2J.
W80-03631

SURF ZONE DYNAMICS DURING UPWELLING ON THE OREGON COAST,
Williams Coll., Williamstown, MA. Dept. of Geology.
W. T. Fox, and R. A. Davis, Jr.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 683-697, December 1979. 9 Fig, 14 Ref. ONR N00014-69-C-0151.

Descriptors: *Coasts, *Beaches, *Upwelling, *Oregon, Beach erosion, Erosion, Deposition(Sediments), Sand bars, Winds, Weather, Tides, Atmospheric pressure, Waves(Water), Ocean waves, Currents(Water), Surf zone.

A 45-day time series study was conducted along the central Oregon coast during July and August 1973. The North Pacific Subtropical High dominated the weather pattern with strong north winds and coastal upwelling. Waves were 1-3 m high with periods of 6 to 9 s. The upwelling was interrupted when low pressure systems passed over the coast. With the low pressure, the wind shifted to the southwest, and the wave height increased. Rip currents and southward longshore currents in the surf zone reached 90 cm/s. The mixed diurnal-semidiurnal tide along the coast had a spring tide range of 4 m. Three beaches were mapped at low tide once every three days. At South Beach, Oregon, 2 sets of bars advanced shoreward at 1 to 5 m/day and expanded to the south at 5 to 15 m/day. A longshore trough and rip channel system which was active at mid-tide separated the bars. At Beverly Beach, a basalt ridge formed an island 400

m long and 730 m offshore. The island functioned as a detached breakwater and formed a protuberance on the beach. Sand bars and rip channels built up on the protuberance and migrated 200 m to the south. At Gleneden Beach, cusps with a wavelength of 40 m were formed on the steep foreshore. Rhythmic topography formed by bars and rip channels with a wavelength of 300 m developed on the nearshore. The bars advanced across the rip channel at 5 m/day and welded onto the foreshore. (Sims-ISWS)
W80-03632

THE ECOLOGY OF SANDY BEACHES IN PENANG, MALAYSIA, WITH SPECIAL REFERENCE TO EXCIROLANA ORIENTALIS (DANA),
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
D. A. Jones.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 677-682, December 1979. 3 Fig, 21 Ref.

Descriptors: *Beaches, *Biological communities, *Isopods, *Asia, Shores, Physical properties, Sampling, Waves(Water), Tropical regions, Biology, *Malaysia, *Penang(Malaysia), Surf zone.

The physical characteristics of a series of beaches of differing exposure on Penang Island, Malaysia, were measured, and the macrofauna were collected quantitatively. The zonation of the fauna on the upper and mid-shore agreed with that described for other tropical beaches, but the sudden transition to mud on the lower shore was exceptional. Excirolana orientalis has a wide distribution on the shore, and its relationship with similar isopods in other areas, where they occur together on the beach, was discussed. (Sims-ISWS)
W80-03633

THE SUBLITTORAL ECOLOGY OF THE MENAI STRAIT, I. TEMPORAL AND SPATIAL VARIATION IN THE FAUNA AND FLORA ALONG A TRANSECT,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
R. Hoare, and M. E. Peattie.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 663-675, December 1979. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Biological communities, *Currents(Water), *Tidal waters, Spatial distribution, Temporal distribution, Current meters, Measurement, Sampling, Turbidity, Scour, Erosion, Data processing, Ecology, Marine biology, *Menai Strait(Wales), Sublittoral organisms, Tidal currents.

The Menai Strait is a narrow channel subject to strong tidal currents but little wave action. The major physical factors which interact to control the nature and distribution of the fauna and flora are turbidity, scouring, current strength, and substratum. A simple device, based upon a spring balance, was used to measure maximum current strength near the bottom. The distribution of the fauna was studied by a transect survey across the Channel and compared with a similar survey in the same place 20 years earlier. The results suggested a high biological stability although some population fluctuations do take place. It was suggested that such general surveys be supplemented by more detailed investigations of individual species. (Sims-ISWS)
W80-03634

TIDAL HYDRAULICS IN ESTUARINE CHANNELS,
Snyder Oceanography Services, Inc., Jupiter, FL.
R. M. Snyder.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15202, p 237-245, February 1980. 3 Fig, 1 Tab, 8 Ref, 2 Append.

Descriptors: *Tidal waters, *Tides, *Channel flow, *Estuaries, Coasts, Harbors, Water circulation, Analog models, Canals, Open channels, Dredging, Flood control, Hydrodynamics, Hydraulics, Coastal engineering.

Alternating hydraulic flow (typical of estuarine areas) cannot be accurately treated using techniques developed for open channels or for the open oceans. As tidal energy approaches our coastlines, the potential energy is converted to kinetic energy resulting in forced vibrations within our estuarine systems. These 'hydraulical vibrations' are periodic rather than truly harmonic but can be considered to be harmonic for a first-order approximation. By making the analogy to electrical alternating current flow with a quadratic resistance term the equation of motion of tidal channel flow can be written. Solution of this harmonic equation in simplified form leads to expressions for channel resistance, channel capacitance, and channel inductance which combine, according to the phase angle between tidal amplitude and tidal current, to form channel impedance. These equations reduce to the familiar Darcy-Weisbach equation for steady-state open channel flow. (Sims-ISWS)
W80-03714

OCEAN TIDE EFFECT STUDY ON A COASTAL CARBONATE AQUIFER (MIOCENE OF ALGARVE, PORTUGAL) ((ETUDE DE L'EFFET DE MAREE OCEANIQUE SUR UN AQUIFERE CARBONATE COTIER (MIOCENE DE L'ALGARVE--PORTUGAL)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
For primary bibliographic entry see Field 2F.
W80-03731

THE ISLAY FRONT: PHYSICAL STRUCTURE AND PHYTOPLANKTON DISTRIBUTION,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
J. H. Simpson, D. J. Edelsten, A. Edwards, N. C. G. Morris, and P. B. Tett.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 713-726, December 1979. 12 Fig, 9 Ref.

Descriptors: *Phytoplankton, *Physical properties, *Oceans, Coasts, Continental shelf, Salinity, Temperature, Water temperature, Currents(Water), Ocean currents, Density, Nutrients, Oceanography, *Fronts(Oceanic), *Scotland coast, *Irish coast.

A shelf sea front exhibiting strong salinity influence was described. Temperature plays only a secondary role in controlling the density although the frontal position conforms to the h/cu u model. Velocity measurements by current meters and radio drogues have defined the tidal flow and indicated residual currents of about 20 cm/s parallel to the front. These flows were time dependent with flow reversal occurring in the lower part of the water column. The observed velocity shear was of the same order as, but not in precise agreement with, the geostrophic shear inferred from the density gradient. In vivo and extracted chlorophyll measurements showed that phytoplankton standing crop at the front was several times greater, and was healthier, than that in the mixed water inshore. Chlorophyll was vertically stratified at the front and in the density-layered water offshore. High standing crop at the front may be explained in terms of nutrient availability to algae in the euphotic zone. The complex physical and biological processes influencing frontal productivity were discussed. (Sims-ISWS)
W80-03733

THE EFFECTS OF OYSTER SHELL DREDGING ON AN ESTUARINE BENTHIC COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
W. G. Conner, and J. L. Simon.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 749-758, December 1979. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Dredging, *Effects, *Biological communities, *Benthic fauna, *Florida, Coasts, Bays, Estuaries, Oysters, Shellfish, Sediments, Cores, Sampling, On-site investigations, Biomass, Biology, *Tampa Bay(FL), Dredging effects, Oyster shells, Species composition.

This paper described the extent and nature of the effects on the benthos of physical disruptions associated with dredging fossil oyster shell. Two dredged areas and one undisturbed control area in Tampa Bay, Florida, were quantitatively sampled before dredging and for one year after dredging. The immediate effects of dredging on the soft-bottom community were reductions in numbers of species (40% loss), densities of macroinfauna (65% loss), and total biomass of invertebrates (90% loss). During months 6-12 after dredging, the analysis used (Mann-Whitney U Test, alpha = 0.05) showed no difference between dredged and control areas in number of species, densities, or biomass (except the E sub 1 area). Community overlap (Czeckanowski's coefficient) between dredged and control areas was reduced directly after dredging, but after 6 months the pre-dredging level of similarity was regained. (Sims-ISWS)
W80-03734

RECENT GEOCHEMICAL HISTORY OF FLOOD DEPOSITS IN THE NORTHERN CHESAPEAKE BAY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-03735

HYDROCHEMISTRY OF DISSOLVED INORGANIC CARBON IN THE ST. LAWRENCE ESTUARY (CANADA),
Quebec Univ., Rimouski. Dept. of Oceanography.
E. Pelletier, and J. Lebel.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 785-795, December 1979. 6 Fig, 2 Tab, 25 Ref.

Descriptors: *Water chemistry, *Estuaries, *St. Lawrence River, Chemicals, Alkalinity, Variability, Seasonal, Sampling, Chemical analysis, Temperature, Water temperature, Salinity, Carbon, Carbonates, Runoff, Discharge(Water), Hydrology, Dissolved inorganic carbon.

The concentration and the distribution of dissolved inorganic carbon were studied in the Upper St. Lawrence Estuary during three seasons in 1976. The data collected by the authors show that the dilution area directly influenced by the St. Lawrence River (mean annual discharge of 11300 cu m/s) is demarcated by the isohaline of 32.5 parts per thousand. The seasonal variations of the alkalinity of freshwater can attain 40%, but the quantity of bicarbonate ions brought by the river varies less than 8% from season to season. Budget calculations of dissolved CaC03 indicate that 45000000 tons per year is provided by the St. Lawrence River. This figure is almost 12 times more than all the suspended matter transported from the same source. (Sims-ISWS)
W80-03736

THE DESIGN AND USE OF AN OSCILLATING TROLLEY WAVE-SIMULATOR, FOR INSTALLATION IN UNIDIRECTIONAL FLOW FLUMES,
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
T. M. Hammond, and M. B. Collins.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 801-811, December 1979. 6 Fig, 19 Ref, 1 Append.

Descriptors: *Flumes, *Equipment, *Waves(Water), *Laboratory equipment, Sediment transport, Current meters, Flow, Shallow water, Hydraulic models, Oceanography, Wave generators.

The constructional details of an oscillating trolley arrangement, for installation in commercially available unidirectional flumes, was described. The apparatus was composed of commercially produced subassemblies and readily available materials. The oscillating trolley and flume were used to simulate combinations of oscillatory (representing near-bed oscillatory motion of waves in shallow water) and unidirectional flows in investigations concerned with the response of various current meter impellers and the threshold of (Woodhead) seabed drift-

ers and noncohesive sand-sized sediment; some of the results of these investigations, of particular relevance to coastal oceanographic investigations, were summarized. (Sims-ISWS)
W80-03737

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W80-03738

PHYTOPLANKTON DISTRIBUTION AND LIGHT ATTENUATION IN PORT HACKING ESTUARY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5C.
W80-03799

SEASONAL OCCURRENCE AND VARIATION IN STANDING CROP OF A DRIFT ALGAL COMMUNITY IN THE INDIAN RIVER, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5C.
W80-03803

THE RELEASE OF REACTIVE PHOSPHATE BY A POSIDONIA AUSTRALIS SEAGRASS COMMUNITY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 2A.
W80-03808

CONSUMPTION OF EELGRASS, ZOSTERA MARINA, BY BIRDS AND INVERTEBRATES DURING THE GROWING SEASON IN LAKE GREVELINGEN (SW NETHERLANDS),
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
For primary bibliographic entry see Field 5C.
W80-03819

SPECIES COMPOSITION AND SEASONAL OCCURENCE OF CENTRIC DIATOMS IN A POLLUTED MARINE ENVIRONMENT,
Karachi Univ. (Pakistan). Inst. of Marine Biology.
For primary bibliographic entry see Field 5C.
W80-03820

WETLANDS OF THE SOUTH-WEST OF WESTERN AUSTRALIA WITH SPECIAL REFERENCE TO THE BUSSELTON AREA.
Australian Department of Fisheries and Wildlife, Perth, 1978, 18 p, 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Wetlands, *Australia, Ecology, Wildlife habitat, Management, Wildlife, Marsh management, Estuaries, Swamps.

General information is given on the wetlands (swamps, rivers, estuaries) of the south-west of Western Australia, their value as wildlife conservation areas, their ecology, and some of the problems of their management. Particular attention is directed towards the wetlands of the Busselton area; namely, the Broadwater, Wonnerup and Vasse Estuaries. A brief account of their value to wildlife and their need for management is given. An outline of the future management trends of these areas is also provided. (Steiner-Mass)
W80-03861

A NUTRITIONAL ANALYSIS OF A SUBLITTORAL DIATOM ASSEMBLAGE EPIPHYTIC ON ENTEROMORPHA FROM A LONG ISLAND SALT MARSH,
City Univ. of New York. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03862

HOLOCENE SEDIMENTATION AT CAPE SABLE, SOUTH FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2J.
W80-03864

LANGEBAAN LAGOON: A MIXED CARBONATE-SILICICLASTIC TIDAL ENVIRONMENT IN A SEMI-ARID CLIMATE,
Cape Town Univ. (South Africa). Marine Geoscience Unit.
For primary bibliographic entry see Field 2J.
W80-03865

DISTRIBUTION OF MACROFAUNA ON A MALAYAN MANGROVE SHORE,
Malaya Univ., Kuala Lumpar (Malaysia). School of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-03870

THE ECOLOGY OF A SALTMARSH IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-03871

INTERPRETATION OF UNENHANCED LANDSAT IMAGERY FOR WETLAND AND LAND USE DELINEATION IN THE TEXAS COASTAL ZONE,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 7C.
W80-03878

STRUCTURE OF MANGROVE FORESTS IN FLORIDA, PUERTO RICO, MEXICO, AND COSTA RICA,
Puerto Rico Dept. of Natural Resources, San Juan.
For primary bibliographic entry see Field 2I.
W80-03879

COMPARISON OF THE ASSEMBLAGES OF SAP-FEEDING INSECTS (HOMOPTERA-HEMIPTERA) INHABITING TWO STRUCTURALLY DIFFERENT SALT MARSH GRASSES IN THE GENUS SPARTINA,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Entomology and Economic Zoology.
For primary bibliographic entry see Field 2I.
W80-03881

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANE DEVELOPMENT - FINAL REPORT,
UOP, Inc., San Diego, CA. Fluid Systems Div.
C. E. Milstead, and R. L. Riley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153539, Price codes: A07 in paper copy, A01 in microfiche. Report to Office of Water Research and Technology, February 1980, 130 p, 40 Fig, 22 Tab. OWRT (No 7511) (1), 14-34-0001-7511.

Descriptors: *Membranes, *Reverse osmosis, *Brackish water, *Desalination, Spiral-wound elements, New Mexico, Arizona, *Roswell(N Mex), Yuma(Ariz), Composite membranes.

The principal objective of this three phase program was to develop a thin-film composite membrane system capable of yielding approximately 20 gal/ft to the 2nd power-day of product water from a brackish feed at 200 psi applied pressure with a rejection of 98%. Four types of composite membranes, prepared by interfacial polycondensation techniques on a fabric-reinforced porous polysulfone support, were evaluated. The optimum membrane, a polyamide, designated TFC-202, was successfully produced in large quantities for spiral-wound element fabrication. This membrane, yielding approx. 24 gal/ft to the 2nd power-day and approx. 98.5% rejection from a Yuma feedwater at 200 psi applied pressure, was fabricated into 2 1/2-,4-,and 8-in. diam. x 40-in. wide elements for field testing at the OWRT Test Facility at Roswell, N.M.
W80-03749

DESIGN OF AN INDIRECT FREEZING PROCESS PILOT PLANT BASED ON BULK CRYSTALLIZATION,
Johnson (Wallace E.) Co., Topsfield, MA.
W. E. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153596, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December 1978. 36 p, 9 Fig, 3 Tab.

Descriptors: *Desalination, *Freezing, Indirect freezing, *Pilot plants, Design, Costs.

This report covers the rationale and design of a 2000 gpd pilot plant to demonstrate Indirect Freezing with bulk crystallization for desalination of water. During the 1950's indirect freezing processes utilizing film or block freezing were investigated and found to be uneconomical. This is a study of a process that employs the simplicity of indirect freezing without the cost of scraped surface heat exchangers on poor thermal efficiency of film or block freezing. An economic study made on the same basis as a recent OWRT commissioned report, showed a water cost of $1.74/1000 gallons at 5 MGD. Calculated energy consumption for a mature 1 MGD plant is 29.2 KW-HR/1000 gal. The pilot plant design is large enough to allow scaling to commercial size yet small enough to facilitate study of bulk crystallization. The estimated 1978 pilot plant cost is $225,000.
W80-03772

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR DISTILLATION FOR LARGE SCALE PRODUCTION IN FRESH WATER.
Bechtel Corp., San Francisco, CA. Research and Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND77-8176, Price codes: A05 in paper copy, A01 in microfiche. Document prepared for Sandia Laboratories, Livermore, California, December 1977, 68 p, 20 Fig, 9 Tab, 3 Ref.

Descriptors: *Desalination plants, *Desalination processes, *Comparative costs, *Distillation, *Solar distillation, Treatment facilities, Desalination, Water treatment, Water purification, Desalination apparatus, Fuel costs, Economics, Equipment, Evaluation, Separation techniques, Solar stills, Solar energy, Economies of scale.

A review of existing technology and of expected rises in fuel-oil costs reveals that, while it is presently cheaper to distill potable water by means of an oil-fired distillation plant (assuming plant size of 5 million gallons/day), costs of distilling water from solar-driven and oil-fired plants will by equal within 15 years. The study concludes: (1) Water costs from a solar-driven vertical tube evaporation (VTE) distillation unit will become competitive with those from oil-fired distillation units within 15 years if annual fuel escalation costs remain in excess of 5%. (2) A comparative assessment of competing solar collector designs should be conducted to identify the economic choice of solar energy collection systems for a distillation plant. (3) Performance of distillers operating with solar power plant waste heat should be evaluated. (4) Water costs from solar stills in some developing countries may be competitive with solar-driven and oil-fired conventional distillers. An existing facility cost audit adjusted to the present time

frame is needed. Research efforts included a literature survey of single- and multi-effect solar stills and solar-driven conventional distillation units. A simplified conceptual design is given of a candidate plant and of a non-solar distillation plant, and an economic comparison is made of alternative designs. (Harris-Wisconsin)
W80-03842

3B. Water Yield Improvement

INTERIM PROGRESS REPORT SUPPLEMENT A -- DATA ANALYSIS, SCPP DATA COLLECTION AND ANALYSIS FOR THE PERIOD 1 JANUARY 1979 THROUGH 30 JUNE 1979,
Atmospherics Inc., Fresno, CA.
M. E. Solak, R. B. Allan, and T. J. Henderson.
Prepared for the Office of Atmospheric Resources Management, Department of the Interior, Water and Power Resources, January 31, 1980. 107 p, 92 Fig, 1 Tab. 9-07-85-V0020.

Descriptors: *Mountains, *Hydrologic data, *Meteorological data, *Precipitation(Atmosphoric), Precipitation gages, Cloud seeding, Weather modification, Sierra Nevada, California, Ice, Snowfall, Rainfall intensity.

Precipitation measurements and ice nucleus counter data collected in the American River Basin in the Sierra Nevada during a six month period in 1978 and 1979 are analyzed. Data were collected from precipitation gages, surface meteorological stations, ice nucleus counters, high volume filter samples, and snow samplers. The data were prepared manually from manually-reduced records. Interpretation of precipitation measurements for the area are complicated by the mountainous terrain, however, the relationship between gage elevation and precipitation accumulation seen in the traverse profiles was considered during isohyetal map production. The manually-produced barrier traverse profiles reflect gage spacing along the traverse with precipitation amounts expressed in millimeters. A general seasonal pattern of increasing precipitation accumulations at increasing elevations is seen for the windward slopes of the barrier with decreasing amounts on the lee slopes, however, some cases differed substantially from this pattern. Precipitation rates analyzed represent the maximum houly accumulation. Ice nucleus measurements are plotted with concentrations expressed in numbers per liter at -20C. Data presented for priority 1, 2, and 3 cases and for significant precipitation periods include a brief description of the case, maps of gage locations, I-80 traverse precipitation profiles, and maps of ice nucleus counter sites with concentrations. (Seigler-IPA)
W80-03779

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
For primary bibliographic entry see Field 6B.
W80-03851

3C. Use Of Water Of Impaired Quality

ENTEROVIRUS INACTIVATION IN SOIL AND STRUCTURAL CHANGES ASSOCIATED WITH THE INACTIVATION OF SOIL-BOUND VIRUSES,
New Mexico State Univ., Las Cruces. Dept. of Biology.
J. G. Yeager, and R. T. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149255, Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University Report No 111, November 1979. 75 p, 12 Fig, 10 Tab, 62 Ref. OWRT A-052-NMEX(7), 14-34-0001-9033.

Descriptors: *Water reuse, *Sewage sludge, *Irrigation, *Soil bacteria, *Viruses, Soil types, Soil properties, Soil water movement, Evaporation, Soil moisture, Arid lands, Evaluation, Enterovirus, Coxsackievirus, Polio virus, *Virus inactivation.

The inactivation of polioviruses in soil was examined. It was shown that the inactivation of radioactively labeled poliovirus type-1 and coxsackievirus B-1 in soils saturated with surface water, groundwater and septic tank liquor was directly proportional to temperature. Virus persistence was also related to soil type and the liquid amendment in which viruses were suspended. No infectivity was recovered from dried soil regardless of temperature, soil type, or liquid amendment. Evaporation was largely responsible for the decreased recovery of infectivity from drying soil, however, increased rates of inactivation at low soil moisture levels may have amplified the virucidal effects of soil evaporation. The experimental results indicated that the loss of infectivity of poliovirus in moist and dried soils was a result of irreversible damage to the virus particles. Results suggest that polioviruses are inactivated by different mechanisms in moist and drying soils. Taken together, the findings suggest that any virus hazard associated with the application of wastewater or sewage sludge to agricultural land can be greatly reduced or eliminated by allowing the soil to dry after waste application. (Herman-NMex)
W80-03603

AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL,
Technion-Israel Inst. of Tech., Haifa. Faculty of Agricultural Engineering.
N. Buras, and P. Darr.
Water Resources Research, Vol 15, No 6, p 1349-1353, December 1979. 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Water reuse, *Brackish water, *Water resources, *Model studies, Mathematical models, Water demand, Water supply, Water sources, Evaluation, Costs, Cost analysis, Cost comparisons, Planning, Water importing, Arid lands, *Israel.

The scarcity of water in Israel and its possible effect on the socioeconomic development of the country have evinced considerable interest in the utilization of marginal waters. A nonlinear mathematical model was formulated, whose dual solution has shown that urban wastewater and brackish water have substantial values ranging up to 65% of the cost of imported freshwater. The nonlinear production function in the mathematical model permitted the detailed analysis of the impact of the economies of scale on the primal and dual solutions. The optimal allocation of water for the Central Negev in 1992 calls for 40% of the forecast total water demand to be supplied by 26 million cu m of treated urban wastewater and brackish water. (Sims-ISWS)
W80-03742

THE POTENTIAL FOR MUNICIPAL WASTEWATER REUSE BY INDUSTRY IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
J. Pratte, and W. Litsky.
In: Proceedings Water Reuse Symposium, March 25-30, 1979, Washington, D.C., Vol 2, p 1235-1246, 1979. 1 Fig, 5 Tab, 5 Ref. OWRT A-114-MASS (2).

Descriptors: *Water reuse, *Waste water, *Water conservation, *Industrial water, Attitudes, Massachusetts.

This investigation sought to determine the suitability of wastewater reuse by industry as a water conservation measure in terms of social, economic, institutional and technological feasibility. Personal interviews, guided by a questionnaire, were held with industrial and public sector individuals. The results indicated that industry is more accepting of wastewater reuse than water resource officials if a project is cost-effective. Although there are few suitable industrial recipients of reclaimed water in Massachusetts, the concept is worthy of more attention as water costs increase, sewage treatment plants are upgraded and alternative water supplies are sought. (See also W80-02760) (Godfrey-Mass)
W80-03747

ALGAE GROWN ON WASTEWATER AS A SOURCE OF PROTEIN FOR YOUNG CHICKENS AND RATS,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
S. Mokady, S. Yannai, P. Einav, and Z. Berk.
Nutrition Reports International, Vol 19, No 3, p 383-390, March 1979. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Beneficial use, *Feeds, *Aquatic algae, *Poultry, *Rodents, *Proteins, Micractinium, Chlorella, Oocystis, Scenedesmus, Chlorophyta, Foods, Sewage lagoons, Oxidation lagoons, Flocculation, Amino acids, Soybeans, Carp.

A study was made to estimate protein nutritive value of several algae species grown on wastewater, as a protein source in diets of young chickens. Rat feeding tests were also carried out, to determine the protein nutritive value of the different algae species and using PER values as a parameter. Results of the rat studies show that most algal samples have a fairly high protein nutritive value, as judged by PER values, even when algae was the only dietary protein source. However, best growth performance for chickens was obtained when algal protein was substituted only for 25% of soybean protein. Algae samples were incorporated into the rations of the experimental chickens as a partial replacement (25-50%) for soybean protein. In studying rat diets, dietary protein was derived from algae alone, from algae and soybean meal in equal parts and from algae supplemented by methionine and lysine; the latter substances are limiting amino acids in algal proteins. Algal samples used in feeding experiments were grown on sewage and drum-dried after harvest. Oocystis, Scenedesmus and Micractinium containing 38.5%, 48.7% and 51% protein, respectively, were harvested by flocculation with alum. Chlorella-euglena consisting mainly of Chlorella sp, containing 54% protein, was harvested by centrifugation. This study is presented as part of a two-paper series; other research discusses secondary toxicology and contaminants which algae pick up from wastewater and the degree to which these toxins are passed on to rats fed chicken and carp fish raised on wastewater algae. (Harris-Wisconsin)
W80-03817

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
S. Yannai, S. Mokady, K. Sachs, B. Kantorowitz, and Z. Berk.
Nutrition Reports International, Vol 19, No 3, p 391-400, March 1979. 4 Tab, 20 Ref.

Descriptors: *Waste water treatment, *Toxicity, *Feeds, *Aquatic algae, *Human pathology, *Poultry, *Carp, Micractinium, Chlorella, Beneficial use, Chlorophyta, Oxidation lagoons, Sewage lagoons, Phosphates, Foods, Phosphorus, Mercury, Copper, Lead, Arsenic, Food chains, Rodents.

A study was conducted to evaluate the wholesomeness of animals (broiler chicken and carp fish) raised on rations containing a large quantity of algae of different species grown on wastewater. Results of secondary toxicity tests indicate that rats raised on diets containing chicken or fish which had been fed wastewater-grown algae did not differ significantly from rats fed chicken and fish which had received control rations. The amount of toxic metals in the unicellular algae (Chlorella and Micractinium) was high, but the only animal tissues affected were chickens' livers. Organochlorine pesticide levels in algae were low in all cases, but considerable PCB levels were found in all plants. There were large amounts of mercury, copper, lead and arsenic in muscle tissues of experimental chicken and mercury in experimental carp liver; these high concentrations did not bring about

corresponding high levels in animal tissues because unusually large amounts of phosphorus (especially as phosphate) occurred in all algae samples assayed. All four of the metals form water-soluble salts with phosphate; it is possible that these metals are thus rendered unabsorbable from the gastrointestinal tract. (Harris-Wisconsin)
W80-03818

3D. Conservation In Domestic and Municipal Use

RESIDENTIAL WATER REUSE,
California Univ., Los Angeles. School of Architecture and Urban Planning.
M. Milne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-155377, Price codes: A23 in paper copy, A01 in microfiche. Technical Completion Report, California Water Resources Center, Davis Report No 46, September 1979. 553 p, 12 Fig, 4 Append. (California Water Resources Center Project UCAL-WRC-W-537).

Descriptors: *Water reuse, *Impaired water use, *Recirculated water, *Reclaimed water, *Water supply, *Architecture, Buildings, Construction, Construction materials, Structural design, Design, Planning, *Domestic wastes, *Domestic use, Beneficial use, *Water conservation, *Public health, *Water law.

Greywater, rainwater, groundwater, and surface water are sources of 'free' water already available to every homeowner on-site. This book explains the various ways to collect, store, treat, and distribute this water, and gives examples of how it has been successfully reused for toilet flushing, landscape irrigation, washing, bathing, or drinking. For many of these functions water can be reused directly without treatment. The argument in favor of water reuse is given along with a brief history of residential water reuse, how rainwater and groundwater can be developed as an on-site supply, the uses of greywater for garden irrigation, various residential-scale systems that have been designed for on-site reuse, and an explanation of the components needed to build such systems. The appendix contains a directory of manufacturers, a glossary of specialized terms, units of measure, and an annotated bibliography containing over 500 citations. The conclusion of this study is that residential on-site water reuse systems are already technically feasible and environmentally sound, and are becoming more economically attractive every day, due primarily to the rapidly increasing cost of energy required for pumping and treatment by centralized water and sewage systems. The objective of this book is to help homeowners, builders, developers, architects, planners, and lawmakers understand the design and installation of small on-site residential water reuse systems. (Snyder-California)
W80-03640

3F. Conservation In Agriculture

FLOW CONTROL DEVICES PARTICULARLY USEFUL FOR DRIP IRRIGATION,
M. Drori.
U.S. Patent No 4,173,309, 7 p, 25 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 103, November 6, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, *Flow control, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance, Drip irrigation.

The fluid flow control devices described are particularly useful as drip irrigation emitters provided with flow regulation to reduce their pressure-sensitivity, enabling them to be used in long lines and in undulating terrain. The disclosed devices include a first flexible plastic strip bonded on one surface to a second plastic strip along bond lines defining a pressure-dropping passageway. A third plastic surface is bonded to the opposite surface of the first flexible plastic strip along bond lines defining a static pressure chamber in which the first flexible plastic serves as a common wall with the chamber and the passageway for at least part of the length of the passageway. Thus variations in the velocity of the fluid through the pressure-dropping passageway causes the common wall to be flexed to vary the cross-sectional area of the passageway and to regulate the fluid flow. Both linear-source emitters and point-source emitters are described. (Sinha-OEIS)
W80-03604

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
For primary bibliographic entry see Field 6E.
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
For primary bibliographic entry see Field 6E.
W80-03814

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
R. J. Michael.
California Water Law Review, Vol 14, No 3, p 563-589, 1979.

Descriptors: *California, *Federal reclamation law, *Irrigation programs, Judicial decisions, Federal jurisdiction, Agriculture reclamation, Water law, Legal aspects, Federal government, Legislation.

Since the early 1900's, the federal government has joined private efforts to improve agricultural reclamation in the Imperial Valley of California. Today, the government's involvement in the irrigation project is the object of judicial interpretation. One difficult issue is who has standing to challenge the various sections of reclamation law. The United States (U.S.) Supreme Court has recently tightened traditional standing requirements in the decisions of Worth v. Seldin and Simon v. Eastern Kentucky Welfare Rights Organization. The U.S. Ninth Circuit Court of Appeals has applied these standing requirements to efforts to challenge the 1902, Reclamation Act. In case of U.S. v. Imperial Irrigation District, the Court resolved the acreage limitation issue, but the Court refused to hear the residency requirements issue. Consequently the plaintiffs were denied access to the federal courts to challenge the nonenforcement of the Act. The present conflicts in the reclamation law should be resolved by congressional clarification instead of judicial interpretation. The Act's residency requirement and acreage limitations have not been amended since 1926. If not clarified the underlying purpose of the 1902 Reclamation Act assisting the family farmer will have been subverted. (Wilson-Florida)
W80-03888

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE ANTICIPATED DECISION INFLUENCE PERIOD IN REAL TIME RESERVOIR OPERATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W80-03645

HARPER SEEKS CLIMATE CONTROL WITH SPRINKLED VEGETABLES,
For primary bibliographic entry see Field 2I.
W80-03658

AEROMONAS DISTRIBUTION AND SURVIVAL IN A THERMALLY ALTERED LAKE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
C. B. Fliermans, R. W. Gorden, T. C. Hazen, and G. W. Esch.
Applied and Environmental Microbiology, Vol 33, No 1, p 114-122, January 1977. 11 Fig, 5 Tab, 15 Ref.

Descriptors: *Heated water, *Fish parasites, *Fish populations, *Water pollution effects, *Epizootiology, Aeromonas hydrophila, Thermal pollution, Par Pond(SC), Nuclear reactors, Fishkill, Pest control, Water temperature, Distribution, Cooling water, Epizoites, Mortality, Aquatic bacteria, Dissolved oxygen.

The survival and distribution of Aeromonas hydrophila in heated natural waters was studied August 1975-1976 in Par Pond, a monomictic lake used as a cooling reservoir for a production nuclear reactor at Savannah River Plant, Aiken, South Carolina. Although it is unclear whether aeromonad survival in Par Pond is due directly to thermal inputs or indirectly related to flow rates and/or nutrient distributions caused by reactor operations, it is clear that aeromonads are ubiquitous throughout the pond and that bass populations are heavily infected by these etiological agents of red sore disease. Aeromonas is commonly pathogenic to fish, frogs, reptiles and humans. Fish populations in the lake have lesions of epizooty from which Aeromonas spp. are readily isolated. Distribution and population densities of this ubiquitous aquatic bacterium were measured seasonally in the water column along an oxygen and temperature gradient. Greater Aeromonas densities occur below the oxygen chemocline when the reservoir is stratified. Survival levels of pure A. hydrophila cultures correspond to distribution patterns of naturally occurring Aeromonas-like populations. Greater survival of A. hydrophila during full reactor operation suggests that fish populations may be exposed to Aeromonas for a longer period of time than when the reactor is not operating. (Harris-Wisconsin)
W80-03787

SEASONAL CHANGES OF BACTERIOPLANKTON IN A RESERVOIR RELATED TO ALGAE. I. NUMBERS AND BIOMASS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
For primary bibliographic entry see Field 5C.
W80-03811

MANAGEMENT OF ELODEA IN AUSTRALIAN IRRIGATION SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
K. S. Bowmer, G. R. Sainty, G. Smith, and K. Shaw.
Journal of Aquatic Plant Management, Vol 17, p 4-12, June 1979. 2 Fig, 5 Tab, 53 Ref.

Descriptors: *Irrigation canals, *Australia, *Herbicides, *Aquatic weed control, Irrigation, Irrigation ditches, Irrigation systems, Aquatic plants, Submerged plants, Aquatic weeds, Plant growth regulators, Ammonia, Economics, Environmental effects, Management, Aromatic compounds, Ecology, Plant populations, Distribution.

Obstructuve elodea weed growth in Australian irrigation canals is temporarily controlled by injection of the herbivide acrylaldehyde (acrolein) and aromatic solvents or ammonia into flowing water; however, major research emphasis is on finding more economical and permanent controls. Other treatments considered economical for smaller irrigation canals include short-term, high-concentration injections of endothal alkylamine salts and simazine applications after canal drainage. However, acrolein is the only herbicide suitable for larger irrigation canals for reasons of convenience, economy, and safety. Chlorfenac is exceptionally effective for longer control and eradication, but due to its water solubility it is not available. Dichlobenil is only moderately effective and is expensive. Placement techniques and slow-release formulations

with alginates, polymers or invert emulsions may make other aquatic weed control methods available in the future. Elodea is not effectively controlled by non-chemical methods. Elodea is a native plant of North America; it was first noticed in Southeast Australian irrigation systems in 1957-1958 and is particularly troublesome in larger supply and drainage canals which carry water throughout the irrigation season. Elodea is a submerged perennial plant which thrives in temperate climatic zones. In Australia, it survives the winter in moist situations in a semidormant state. (Danovich-Wisconsin)
W80-03825

ASSESSMENT OF AQUATIC WEED PROBLEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
D. S. Mitchell.
Journal of Aquatic Plant Management, Vol 17, p 19-21, June 1979. 1 Tab, 5 Ref.

Descriptors: *Aquatic weed control, *Data collections, *Analytical techniques, Ecology, Aquatic weeds, Economics, Size, Computer programs, Data processing, Developing countries, Decision-making, Inspection, Surveys, Testing procedures, Plant populations, Plant growth, Sites, Invasion.

A field assessment form for aquatic weed control characterizes the site, identifies weeds, assesses their nuisance status and appraises potential to promote or inhibit water quality. The field assessment form is useful for aquatic weed evaluations to be carried out systematically and objectively particularly in developing countries, since the sole assessment criteria in many cases is weed population size. The suggested form encompasses main data types likely to be important in full problem evaluation. The assessment form includes evaluation of ecological and economic factors on a quantitative basis and data is suitable for computer storage and analysis. Coding is employed for data such as type of water body, weed introduction method, and species name. Aquatic weed ecology factors include hydrological regime stability, nutrient status, climatic conditions, plant growth and reproduction potential, plant effects on environmental physicochemical and biotic factors and whether plants are alien species. An essential requirement for predicting increase in weed population size is an estimate of plant growth rate in the conditions present at the infestation site. Plant vigor, as shown by health and size, indicates site suitability. Temperature and nutrient availability varies seasonally, therefore, it is undesirable to measure growth rates at the most favorable and unfavorable seasons. (Danovich-Wisconsin)
W80-03826

A NEW APPROACH FOR SALVINIA CONTROL,
Queensland Dept. of Lands, Brisbane (Australia).
G. Diatloff, A. N. Lee, and T. M. Anderson.
Journal of Aquatic Plant Management, Vol 17, p 24-27, June 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Herbicides, *Aquatic weed control, *Surfactants, *Salvinia, Chemcontrol, 2,4-D, Aquatic plants, Aquatic weeds, Environmental effects, Oil, On-site tests, Sulfonates, Floating plants, Kerosene, Toxicity, Water hyacinth, Australia.

Experiments show that a mixture of 20 g diuron and 150 g calcium dodecylbenzene sulfonate per liter of formulation with acetone and kerosene as cosolvents completely controls the aquatic weed salvinia. The above mixture is diluted 1 to 10 with kerosene and is available in Australia for large scale experimental purposes under the code name AF 101. Kerosene phytotoxic properties were recognized for many years but its ability to spread out as a very thin layer on water was limited. Oil-soluble surfactant calcium dodicylbenzene sulfonate additions in low concentrations to kerosene greatly increases it spread over both water and salvinia emergent fronds. The surfactant at 1.5%-2.0% W/V gives significantly better results than at lower concentrations. Additions of herbicides, 2,4-D and dishlorprop significantly improve kerosene/surfactant effects, but do not give complete control. Herbicide diuron additions at all levels give complete control. AF 101 is also successful for large scale experimental treatment of red azolla and water lettuce. Formula modification to incorporate 2,4-D instead of diuron completely controls water hyacinth problems. Submersed species are unaffected by the floating herbicide. Water contamination following AF 101 application is minimal implying that this technique is environmentally acceptable. (Danovich-Wisconsin)
W80-03827

THE USE OF MULTIPLE INVERSION AND CLEAN-FLO LAKE CLEANSER IN CONTROLLING AQUATIC PLANTS,
Clean-Flo Labs., Inc., Hopkins, MN.
R. L. Laing.
Journal of Aquatic Plant Management, Vol 17, p 33-38, June 1979. 7 Fig, 6 Tab, 9 Ref.

Descriptors: *Aquatic weed control, *Destratification, *Nutrient removal, *Crystal Lake(MN), Edina Pond(MN), Peavey Lake(MN), Aquatic plants, Aquatic weeds, Chemcontrol, Turnovers, Water circulation, Nutrients, Pondweeds, On-site tests, Chemical precipitation, Submerged plants, Plant growth regulators, Plant growth, Plant populations, Filamentous algae, Algae.

Monitoring of effects of Multiple Inversion and Clean-Flo Lake Cleanser upon aquatic plant communities in three Minnesota lakes June-October 1974 shows that in the long-term, submergent plants will probably respond to nutrient reduction. A Multiple Inversion system introduces microscopic bubbles into the bottom water, inducing turnover. Clean-Flo Lake Cleanser, a soluble calcium compound, accelerates phosphorus removal. Crystal Lake has 29.5 ha area and 10.7 m maximum depth. Edina Pond, 2.4 ha, serves as a storm sewer reservoir and has 1.0 m average depth and 2.0 m maximum depth. Peavey Lake has 2.6 ha area, is 27.4 m deep and is connected to 6444 ha Lake Minnetonka by a 100 m long channel. Until 1970, Peavey served as a sewage settling pond. Edina Pond responded least to treatment since it was completely flushed with storm water runoff after treatment. In Crystal Lake, filamentous algae completely disappeared after treatment but temporary regrowth occurred after heavy rains Flatstem pondweed declined 79% in Crystal Lake, but then recovered completely after June rains. Peavey Lake, treated after the rains, had an immediate 99% decline in filamentous algae compared to controls. After repeated treatment the following year, flatstem pondweed and filamentous algae were controlled 90-100% in Crystal Lake and coontail, Berchtold's pondweed, western pondweed, and filamentous algae were controlled 90-100% in Edina Pond. (Danovich-Wisconsin)
W80-03828

ESTABLISHMENT OF WATERHYACINTH WEEVIL POPULATIONS IN LOUISIANA,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
J. H. Manning.
Journal of Aquatic Plant Management, Vol 17, p 39-41, June 1979. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Water hyacinth, *Louisiana, *Aquatic weed control, *Biocontrol, *Plant growth regulators, Herbicides, 2,4-D, Aquatic plants, Aquatic weeds, Hosts, Integrated control measures, Biological treatment, Chemcontrol, Swamps, Insects, Population, Reproduction, Vegetative reproduction.

After two water hyacinth weevil species (Neochetina eichhorniae and Neochetina bruchi) were introduced in Louisiana in 1974, water hyacinth vegetative reproduction stress was observed. Flowering at Sorrento and Alexandria, nursery areas for N. eichhorniae weevils, was reduced in 1976. Damage by N. eichhorniae and the severe 1977 winter combined to elimate water hyacinth plants from Sorrento. N. bruchi populations are increasing but are presently being invaded by N. eichhorniae. Pure N. bruchi populations probably cannot be established in Louisiana to be used for collection and release on a large scale basis. The Louisiana Department of Wildlife and Fisheries is optimistic that both weevil species are aiding water hyacinth control programs, especially in areas inaccessible to herbicide spray crews. Aerial surveys in November 1977 disclosed an estimated 480,000 ha of water hyacinth in Louisiana. Much of this infestation occurs in dense South Louisiana swamps, where access by spray crews is limited by 5 cm-0.6 m water levels. Chemical control with 2,4-D began in 1946 and continues today. However, to control water hyacinth in inaccessible swamp areas, host-specific biological agents, two species of South American weevil, were introduced. (Danovich-Wisconsin)
W80-03829

BIOLOGICAL CONTROL OF HYDRILLA VERTICILLATA ROYLE WITH GRASS CARP (CTENOPHARYNGODON IDELLA VAL),
University of Central Florida, Orlando. Dept. of Biological Sciences.
J. A. Osborne, and N. M. Sassic.
Journal of Aquatic Plant Management, Vol 17, p 45-48, June 1979. 3 Fig, 4 Tab, 18 Ref.

Descriptors: *Biocontrol, *Carp, *Fish establishment, *Aquatic weed control, *Little Lake Barton(FL), *Fish stocking, Aquatic plants, Aquatic weeds, Integrated control measures, Plant growth regulators, Biomass, Plant growth, Water temperature, Primary productivity, On-site tests, Fish populations, Fish diets, Number fish per acre, Management.

Stocking of grass carp was the major factor in a decline of hydrilla during October 1976-October 1978 in Little Lake Baront, Florida. Annual mean hydrilla biomass was 1.700 kg fr wt/sq m for 1976-1977 and 0.923 kg fr wt/sq m for 1977-1978, representing an annual 45.7% decrease in biomass. Net primary productivity was -8.0 g/sq m/d for 1976-1977 and -22.0 g/sq m/d for 1977-1978 or approximately three-fold lower during the second study year. Hydrilla biomass in October, 1977 was 22.1% lower than in October, 1976; hydrilla biomass in October, 1978 was 55.5% lower than in October, 1977. Hydrilla biomass leveled off when it reached 2.2 kg fr wt/sq m in August, 1977, while it reached only 1.012 kg wt/sq m by October, 1978. Although the lowest temperature occurred during the second year, seasonal trends were similar between study years. Little Lake Barton, Orange County, Florida with 1.63 m mean depth, is a 5.42 ha solution basin which has had hydrilla infestation since 1971. Initial grass carp stocking in October 1976 consisted of 32 fish/ha with 2.6 kg/ha mean weight. During August 1977 a fish kill occurred and in October 1977, 15 fish/ha were placed in the lake. Selective grass carp removal at the end of two years provided a 13 fish/ha population estimate and 90.13 kg/ha biomass. (Danovich-Wisconsin)
W80-03830

TAXONOMIC CHARACTERISTICS OF AQUATIC PLANTS FROM THE ALIMENTARY TRACT OF GRASS CARP,
Florida State Game and Fresh Water Fish Commission, Eustis. Eustis Fisheries Research Lab.
C. C. Carter, and R. S. Hestand.
Journal of Aquatic Plant Management, Vol 17, p 49-53, June 1979. 10 Fig, 7 Ref.

Descriptors: *Classification, *Carp, *Aquatic weed control, *Digestion, *Plant tissues, Systematics, Aquatic plants, Animal physiology, Biodegradation, Food habits, Diets, Plant morphology, Plant physiology, Vascular tissues, Plant groupings, Leaves, Speciation, Macrophytes, Algae.

This paper constructs a taxonomomic key to help identify various plant species ingested by grass carp. Key characters in identifying macrophytes when masticated are included. Ten aquatic macrophytes and one high algae were selected for investigation: Brazilian elodea, hydrilla, eelgrass, pondweed, cabomba, Eurasian watermilfoil, common bladderwort, southern naiad, coontail, dwarf arrowhead and muskgrass. Larger pondweed fragments are obtained in the analysis; however, the

long and narrow thread-like capillary divisions of fanwort and Eurasian watermilfoil are easier to identify. These thread-like divisions are discernible and apparently pass through the mastication process almost intact. Plants with longer, broader leaves such as pondweed and eelgrass, suffer more damage in the grinding process. Discernible fragment characters are found for all hydrophytes investigated except common bladderwort where fragments are ground beyond recognition. Coontail leaf apex is rounded to truncate with two spines located an equal distance from apex producing a horned-like appearance. Minute subtle character differences are found between elodea and hydrilla. Brazilian elodea leaves exhibit a distinct smooth margin and surface texture and have small marginal teeth pointing forward. Hydrilla leaves exhibit a distinct scabrous or harsh marginal and surface texture and bear minute teeth directed outward. (Danovich-Wisconsin)
W80-03831

EFFECTS OF MECHANICAL CUTTING ON SUBMERSED VEGETATION IN A LOUISIANA LAKE,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
R. E. Johnson, and M. R. Bagwell.
Journal of Aquatic Plant Management, Vol 17, p 54-57, June 1979. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Mechanical control, *Harvesting, *Aquatic weed control, *Lake Bistineau(LA), *Black Bayou Lake(LA), Aquatic weeds, Aquatic plants, Biomass, Submerged plants, Plant growth, Costs, Plant growth regulators, Root development, Rooted aquatic plants, Eutrophication, Plant populations, Management, Control, Vegetation regrowth, Cutting management.

Large scale mechanical cutting of submersed vegetation in Louisiana reservoirs is not feasible. The limited period of control gained by cutting vegetation is offset by the comparatively slow machine operation rate. Using mechanical cutting machines to open or maintain boat roads through rooted, submersed vegetation could be beneficial; however, the area cut would have to be extremely large for cost/ha figures to be economically feasible. Costs for 86 operating days during the 1975 season on Lake Bistineau, Louisiana, amounted to $34.27/ha. Operating and maintenance expenses for this time period were $1,081 and labor costs were $1,541. Annual depreciation on equipment was $2,284 and down-time was 34.5% of project time cost. Vegetation cut in May was near the surface again in late August, indicating only temporary control over submersed rooted vegetation. On Black Bayou Lake, average egeria, coontail and bladderwort biomass varied 1036-1712 g/sq m in July 1975. Two months after cutting, biomass varied 834-1388 g/sq m. Regrowth from rooted plants began immediately and continued until September. Average regrowth length varied 29-30.5 cm. In order to evaluate egeria cutting survival, 500 cuttings were introduced into sample plots; 365 new plants were produced indicating that serious problems with new aquatic weed infestations could occur in non-infested portions of a water body by cut plant fragments movements. (Danovich-Wisconsin)
W80-03832

MECHANICAL HYDRILLA CONTROL IN ORANGE LAKE, FLORIDA,
Army Engineer District, Jacksonville, FL.
J. T. McGehee.
Journal of Aquatic Plant Management, Vol 17, p 58-61, June 1979. 1 Fig.

Descriptors: *Mechanical control, *Harvesting, *Aquatic weed control, *Orange Lake(FL), Aquatic weeds, Aquatic plants, Biomass, Plant growth, Costs, Cutting management, Plant growth regulators, U.S. Army Corps of Engineers, Equipment, Integrated control measures.

Aqua-Trio equipment controlled Hydrilla in 65 ha of Orange Lake, Florida for four months in 1977; this included 42 km of trail and 14 use areas. During this period 1100 loads of hydrilla were cut and disposed of either in openwater disposal areas or on upland. Load weights ranged 776-1869 kg indicating that 1,452,500 kg of hydrilla were removed. Total costs were $73,200; cost/ha was $1,125 for the full period. Costs are competitive with chemical control methods. Disposing cut vegetation in lake shallows and increasing the time between recuts can effectively double the work that can be performed. In areas of almost complete infestation, mechanical systems are effective tools in intergrated hydrilla control. Equipment results are direct and immediate. Orange Lake is located in north central Florida and has a 5,261 ha surface area. It is historically a prime fishing lake for largemouth bass and bream. The lake was over 90% infested with hydrilla in 1976. (Danovich-Wisconsin)
W80-03833

SEASONAL VARIATION IN THE BIOMASS, TUBER DENSITY, AND PHOTOSYNTHETIC METABOLISM OF HYDRILLA IN THREE FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Botany; and Florida Univ., Gainesville. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W80-03834

BRITISH COLUMBIA AQUATIC PLANT MANAGEMENT PROGRAM,
Department of the Environment, Victoria (British Columbia).
P. R. Newroth.
Journal of Aquatic Plant Management, Vol 17, p 12-19, June 1979. 3 Fig, 4 Tab, 24 Ref.

Descriptors: *Okanagon Valley, British Columbia, Canada, *Herbicides, Aquatic weed control, *Mechanical control, *Eurasian watermilfoil, Aquatic plants, Aquatic weeds, Lakes, Plant populations, Distribution, Plant growth regulators, Harvesting, Chemcontrol, 2,4-D, Water management(Applied), Project planning, Institutions, Administration, Control.

Main components of the British Columbia Aquatic Plant Management Program are: survey, mapping and documentation of Eurasian watermilfoil (Myriophyllum spicatum); ecological research; mechanical and chemical control technology evaluation; and attempts at containment and quarantine. Since 1975 detailed mapping of Eurasian watermilfoil populations has been performed and by 1977 this plant occupied 580 ha in Ikanagan Valley mainsten lakes, British Columbia. Approximately 205 ha were treated by mechanical methods in 1978. Equipment includes harvesters, rotovators, and small diver-operated suction dredges. Rotovators operate over a much longer season than harvesters; however, their speed is slow and costs are high compared to harvesting. Small diver-operated suction dredges are particularly valuable in removing plants adjacent to water intakes, around docks, breakwaters and other obstacles. Because of high diver pay rates and slow operation speed, these units are practical only in small new infestation areas. Fragments generated by harvesters and rotovators must be contained by floating barriers deployed around machine operation to prevent regrowth and further Eurasion watermilfoil expansion. Herbicide 2,3-D is effective and kills plant roots in most treatments. However, permits must be obtained to ensure that levels are below 0.001 ppm near public water intake systems. Buffer zones of 200-1500 m between treatment areas and active water intakes are recommended. (Danovich-Wisconsin)
W80-03840

FORMULATING AQUATIC WEED MANAGEMENT PROGRAMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
D. S. Mitchell.
Journal of Aquatic Plant Management, Vol 17, p 22-24, June 1979. 2 Tab, 7 Ref.

Descriptors: *Aquatic weed control, *Cost-effectiveness, *Cost-benefit analysis, *Analytical techniques, *Economics, Aquatic plants, Aquatic weeds, Management, Water management(Applied), Costs, Environmental effects, Methodology, Decision-making, Multiple-purpose projects, Evaluation, Testing procedures, Aesthetics.

Cost-effectiveness analysis provides a framework for systematic evaluation of both quantifiable and non-quantifiable data relevant to aquatic weed management. This approach is merited when expensive control measures are needed in complex situations. Cost-effectiveness analysis is a systematic method of selecting alternatives by rational evaluation and cost and effectiveness comparisons. Cost-effectiveness characteristics are: (1) objectives are carefully formulated and unambiguously stated; (2) both non-quantifiable and quantifiable factors are considered; (3) judgements based on experience are employed in the analysis; (4) alternative courses of action are explicitly evaluated; (5) alternative selection is based either on fixed costs or fixed effectiveness; and (6) all factors required to reach a sound decision are objectively displayed for the decision-maker. Weighting criteria may also be assigned by pair comparisons and sensitivity analysis may be performed on the tabulated data. A simplified cost-benefit analysis approach is also outlined. Its major disadvantage is that all factors are evaluated in commensurate money units; this is difficult for ecological and aesthetic benefits or detriments. It is also difficult to estimate, in financial terms, adverse effects of aquatic weed control measures. (Danovich-Wisconsin)
W80-03841

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
For primary bibliographic entry see Field 6B.
W80-03851

4B. Groundwater Management

PROCEEDINGS OF THE TWELFTH BIENNIAL CONFERENCE ON GROUNDWATER, SACRAMENTO, SEPTEMBER 20-21, 1979.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151186, Price codes: A10 in paper copy, A01 in microfiche. California University, Davis, Water Resources Center Report No 45, November 1979. 209 p, 56 Fig, 21 Tab, 3 Append.

Descriptors: *Groundwater, *Groundwater management, *Groundwater potential, *Groundwater basins, *Groundwater availability, *Groundwater recharge, *Groundwater resources, *California.

This conference concentrated on groundwater and groundwater management in California. Many aspects of groundwater management are examined including water rights, legal aspects, storage, pollution, public policy, recharge and conjunctive use of groundwater and surface water. (Snyder-Calif)
W80-03641

THE ECONOMIC CONSEQUENCES OF ALLOCATING GROUNDWATER TO COMPETING INTEREST IN THE SANTA CRUZ BASIN, PIMA COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W80-03707

DEVELOPMENT OF GROUND WATER IN THE HOUSTON DISTRICT, TEXAS, 1970-74,
Geological Survey, Austin, TX. Water Resources Div.
R. K. Gabrysch.
Texas Department of Water Resources Report 241, January 1980. 49 p, 22 Fig, 6 Tab, 22 Ref.

Descriptors: *Groundwater, *Withdrawal, *Water supply, *Water level fluctuations, *Aquifer man-

agement, *Drawdown, Water quality, Saline water intrusion, Water resources development, Aquifer characteristics, Texas, *Houston district, Chicot aquifer, Evangeline aquifer, *Harris County(Tex), *Galveston County(Tex).

Total withdrawals of ground water in the Houston district, Texas, increased 9 percent from about 488 million gallons per day in 1970 to about 532 million gallons per day in 1974. The average annual rate of increase from 1960 to 1969 was about 6.3 percent. During 1970-74, increases in pumpage occurred in the Houston, Katy, and NASA areas; decreases occurred in the Pasadena and Alta Loma areas; and the pumpage in the Baytown-La Porte and Texas City areas remained almost constant. Water levels continued to decline throughout the district during 1970-74, but the rate of decline generally was not as great as in previous years. The greatest declines in the past several years were in the Houston area, but the center of decline is still in the Pasadena and Baytown-La Porte areas. The decrease in the rate of decline suggests that the aquifers in the Houston district could support the amount of pumping during 1970-74 with little, if any, further decline. Although saltwater encroachment has probably occurred in the district, particularly in Galveston County, no large increases in chloride were measured at the monitoring points. (Kosco-USGS)
W80-03768

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
For primary bibliographic entry see Field 6E.
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
For primary bibliographic entry see Field 6E.
W80-03814

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
For primary bibliographic entry see Field 3F.
W80-03888

4C. Effects On Water Of Man's Non-Water Activities

EROSIONAL ASPECTS OF MANAGING URBAN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 2J.
W80-03773

4D. Watershed Protection

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W80-03725

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
J. V. Hunter.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 73-83, 1978. 25 Ref.

Descriptors: *Water quality, *Biochemical oxygen demand, *Mathematical models, *Laboratory tests, Rivers, Measurement, Kinetics, Oxygen demand, Dissolved oxygen, Model studies, Mathematics, Analytical techniques, Methodology, On-site tests, Analysis, Aquatic environment, Benthal oxygen demand, Sediment oxygen demand.

As a measure of effluent and receiving water organic matter content, the BOD determination has been justifiably criticized. However, it is the only determination that indicates the oxygen consumptive capacities of organics in receiving water. The problems associated with the determination involve the mathematical description of the kinetics, extrapolation to actual stream conditions, and, in common with the benthal oxygen demand, difficulty in separating photosynthetic respiration from actual net oxygen consumption. (See also W80-03606) (Humphreys-ISWS)
W80-03612

ALGAL GROWTH POTENTIAL--LOWER WILLAMETTE RIVER, OREGON,
Portland State Univ., OR. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-03614

TRACE ELEMENT LOADING OF SOUTHERN LAKE MICHIGAN BY DRY DEPOSITION OF ATMOSPHERIC AEROSOL,
Governors State Univ., Park Forest South, IL. Coll. of Environmental and Applied Sciences.
For primary bibliographic entry see Field 5B.
W80-03621

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-03629

THE EFFECT OF THE DEGREE OF MINERALIZATION OF WATER ON PHYTOPLANKTON,
Gosudarstvennyi Nauchno-Issledovanii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Gorkii (USSR). Gorkii Lab.
L. I. Pushchina.
Hydrobiological Journal, Vol 14, No 4, p 99, 1978.

Descriptors: *Phytoplankton, *Salinity, *Dominant organisms, Habitats, Water chemistry, Adaptation, Aquatic algae, Diatoms, Cyanophyta, Biomass, Salt tolerance, Seasonal, Ponds, Agriculture.

The algal flora in fish-breeding ponds was studied. Despite differences in salinity more than 40 species of algae were common to all the ponds. The number of Protococcaceae species decreased with increasing salinity. The Euglenophyceae and Volvocaceae were mainly freshwater forms found predominantly under conditions of minimum salt content. The content of dissolved salts also affects the quantitative development of the algae. The mean seasonal biomass of the phytoplankton was greatest in ponds with the lowest water salinity and least in those with the highest salinity. (Deal-EIS)
W80-03664

A PERIPHYTON GROWTH SUBSTRATE USEFUL FOR NUTRIENT IMPACT STUDIES IN LARGE RIVERS,
Saskatchewan Dept. of the Environment, Regina.
D. T. Waite.
Water Research, Vol 13, p 1347-1349, 1979. 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Research equipment, *Periphyton, *Monitoring, Sewage effluents, Growth rates, Water quality, Rivers, Flow rates, Methodology, Nutrients, *Artificial substrates, *Substrates.

In order to facilitate the study of the effects of point source nutrient releases on large rivers a specialized substrate holder was devised. In field testing periphyton growth was analyzed under a variety of water conditions. The substrate rafts performed well in a wide range of water speeds. A schematic drawing of and materials list for the substrate holder are provided. (Deal-EIS)
W80-03665

RANGIA CUNEATA IN AN INDUSTRIAL WATER SYSTEM (BIVALVIA: MACTRIDAE),
Delaware Univ., Lewes. Coll. of Marine Studies.
C. L. Counts, III.
The Nautilus, Vol 94, No 1, p 1-2, 1980. 4 Ref.

Descriptors: *Clams, Fouling, *Water supply, Spatial distribution, Habitats, Delaware River, Chesapeake Bay, Ecological distribution, Migration, Benthic fauna, Oil refinery, *Rangia.

Rangia cuneata is commonly found in fresh and brackish coastal waters from Chesapeake Bay to Texas. This paper reports on the first appearance of R. cuneata in Delaware Bay. Adult specimens were collected from the water system of an oil refinery. It is assumed that the clams migrated through the Chesapeake-Delaware Canal which connects northern Chesapeake Bay with the Delaware River. The biofouling problems created by the clam are discussed. (Deal-EIS)
W80-03669

AN ARTIFICIAL MICROBIAL ECOSYSTEM FOR DETERMINING EFFECTS AND FATE OF TOXICANTS IN A SALT-MARSH ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
A. W. Bourquin, M. A. Hood, and R. L. Garnas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 181, Price codes: A02 in paper copy, A01 in microfiche. Development in Industrial Microbiology, Vol 18, p 185-191, 1977. 4 Fig, 1 Tab, 13 Ref. EPA-600/J-77-075.

Descriptors: *Research equipment, *Bioassay, *Bacteria, *Salt marshes, Laboratory tests, Laboratory equipment, Metabolism, Mode of action, Toxicity, Radioisotopes, Radiochemical analysis, Tracers, Microbial degradation, Monitoring, Methodology, *Parathion.

An artificial laboratory environment designed to determine microbial interactions with pollutant chemicals is proposed. The system is designed to obtain maximum reproducibility between replicates by dividing a single tank into separate closed chambers. Radiolabeled toxicants are added directly to the core-chambers and monitored for metabolic breakdown. Further information is obtained easily on changes in microbial, physiological indexes induced by the toxicants. Techniques for monitoring effects on the methyl parathion on the microbial population and the fate of this chemical are given. (Deal-EIS)
W80-03670

COMPARISON OF VARIOUS METHODS FOR ESTIMATING THE QUALITY OF WATER BASED ON BOTTOM-DWELLING INDICATOR INVERTEBRATES,
Ukranian Hydrobiology Inst. Kherson (USSR). Kherson Hydrobiological Station.
T. G. Moroz.
Hydrobiological Journal, Vol 14, No 3, p 96-99, 1978. 1 Tab, 11 Ref.

Descriptors: *Bioindicators, *Analytical techniques, *Water quality, Benthic fauna, Rivers, Methodology, Monitoring, Mathematical models, Oligochaetes, Diptera, Mollusks, Aquatic insects, Dniepr River.

The application of a number of methods for the monitoring of pollution on various sections of the Lower Dniepr has made it possible to recommend the method of Gudnight and Whitley, which should be further perfected in accordance with the Drachev classification adopted in the Soviet

Union. Reasons are given why other methods described in the literature cannot be used for rivers of this type. (Deal-EIS)
W80-03673

QUANTITATIVE EXTRACTION OF CHLORINATED ORGANIC PESTICIDES AND POLYCHLORINATED BIPHENYLS FROM FISH ORGANS AND TISSUES,
Institute of Experimental Meteorology Obrinsk (USSR).
E. I. Babkina, and T. I. Bobovnikova.
Hydrobiological Journal, Vol 14, No 3, p 85-87, 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Chemical analysis, *Methodology, *Solvents, Analytical techniques, Testing procedures, Chemical properties, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, Gas chromatography, *Tissue analysis.

A relationship is shown to exist between the extracting agent and the rate of extraction of chlorinated organic pesticides (COP) and polychlorinated biphenyls (PCB). Maximum extraction can be achieved only with polar solvents (acetone, esters, alcohols), followed by redistribution of the pesticides from these solvents into nonpolar solvents (hexane, petroleum ether). A method is proposed for the separate determination of COP and PCB in fish organs and tissues. The sensitivity of this method is equal to 0.001-0.006 mg/100 g fish oil for COP and 0.01-0.02 mg/100 g fish oil for PCB. The detection of COP and PCB amounts to 70-90%. (Deal-EIS)
W80-03674

A METHOD FOR STUDYING THE EXCRETORY FUNCTION OF FISH KIDNEYS UNDER CHRONIC EXPERIMENTAL CONDITIONS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. D. Romananko, and N. I. Kotsar.
Hydrobiological Journal, Vol 14, No 3, p 99-101, 1978. 2 Fig, 7 Ref.

Descriptors: *Analytical techniques, *Fish physiology, *Methodology, Laboratory tests, Testing procedures, Bioassay, Research equipment, Fish behavior, Aquaria, Sampling, *Fish kidney function, *Urinalysis.

A method is described for collecting urine samples in fish through a chronic bladder fistula applied in the abdominal wall region. The urine flowing through the fistula tube is collected in a special urine collector attached to the anal fin, from which it is taken out with a thin flexible tube, the free end of which is kept on the surface of the water with a float, while the other end is inserted into the urine collector. With the aid of the method proposed here, urine can be collected from free-swimming fish without taking them out of the water. (Deal-EIS)
W80-03675

VARIATION IN THE REACTIONS OF DAPHNIA MAGNA STRAUS TO THE EFFECT OF A TOXICANT AS RELATED TO ITS DELIVERY REGIME,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
S. N. Kushnikova.
Hydrobiological Journal, Vol 14, No 4, p 86-91, 1978. 2 Tab, 11 Ref.

Descriptors: *Toxicity, *Daphnia, *Bioassay, *Methodology, Organic compounds, Acids, Analytical techniques, Testing procedures, Mode of action, Chemical properties, *Acetic acid.

The reaction of Daphnia to interrupted and intermittent regimes of exposure to a toxicant may differ appreciably from the reactions to constant exposure. The choice of a constant regime in toxicological experiments is not apparently always justified, since the interrelationship between the organism and the poison are more complex than would appear on the basis of data obtained from stable exposure. At the maximum concentrations of the toxicant (acetic acid) the exposure regime does not have a significant influence on Daphnia. The strength of the stimulating or inhibiting action of the toxicant is largely dependent on the frequency with which the solutions are changed. An interrupted regime has a lesser toxic effect than an intermittent regime. (Deal-EIS)
W80-03676

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
K. Brander.
J. Cons int Explor Mer, Vol 38, No 3, p 286-292, 1979. 3 Fig, 2 Tab, 1 App, 15 Ref.

Descriptors: *Water temperature, *Growth rates, *Toxicity, Marine fish, Fish physiology, Fish populations, Animal growth, Atlantic Ocean, Thermal stress, Adaptation, North Atlantic, British Isles, *Cod, Tissue analysis, *Vertebrae.

An inverse relationship between water temperature during early development and mean vertebral number (VS, includes urostyle) is established for cod populations throughout the North Atlantic, but the extent to which differences in VS are inherited is unknown. The VS of different year classes of cod from the North Sea shows some dependence on water temperature and the year class should therefore be taken into account, where possible, when seeking evidence of separation between stocks. Values of VS for populations around the British Isles are plotted on the chart of mean March surface temperature and in general agree with the established temperature-VS relationship. Two areas for which the vertebral numbers seem anomalous are the English Channel and the northeast Irish Sea and these anomalies are discussed. (Deal-EIS)
W80-03680

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
D. Taylor.
Residue Reviews, Vol 72, p 33-69, 1979. 6 Tab, 142 Ref.

Descriptors: *Mercury, *Toxicity, *Aquatic life, Mortality, Mode of action, Aquatic algae, Mollusks, Crustaceans, Freshwater fish, Salmonids, Water chemistry, Heavy metals, Water temperature, Salinity, Lethal limit, Bioassay, Chemical properties, *Bioavailability, *Methylmercury.

One hundred scientific papers published between 1937 and 1976 have been reviewed as part of an attempt to assess the environmental significance of mercury in natural waters. In general, the lethal effects on aquatic life of both inorganic and organic mercury compounds appear at concentrations greater than ten microg/l. Similarly, sub-lethal responses to inorganic mercury occur where concentrations are greater than three microg/l. Organic mercury is apparently more harmful, the corresponding concentration being greater than 0.1 microg/l. Aquatic algae and the larval stages of molluscs and crustaceans appeared to be the most sensitive organisms to mercury. The conclusions reached following investigations under controlled conditions in the laboratory do not necessarily apply in the natural environment and this is particularly true for mercury. Probably the most important factor to be considered is the form in which the mercury is present in the environment, since natural processes such as adsorption, precipitation, volatilisation, and complexation are likely to reduce the concentration of 'biologically available' mercury. In addition, antagonistic reactions may reduce its effect. (Deal-EIS)
W80-03683

IN VITRO INHIBITION OF THREE PHOSPHATASES BY MERCURIC CHLORIDE AND THEIR REVERSAL BY CHELATING AGENT EDTA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and K. Sharma.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 741-746, 1979. 2 Tab, 23 Ref.

Descriptors: *Enzymes, *Inhibition, *Mercury, Phosphates, Organic compounds, Biochemistry, Proteins, Fish physiology, Animal metabolism, Heavy metals, Chelation, *EDTA, *Channa, *Tissue analysis.

In vitro studies revealed that mercury is quite effective in inhibiting the activities of three Channa punctatus brain enzymes (alkaline phosphatase, acid phosphatase, glucose-6-phosphatase). The degree of inhibition is directly proportional to the increase in the concentration of mercuric chloride in the culture medium. EDTA was found to be capable of restoring the activity of all three enzymes. The degree of restoration increased with the increase in EDTA concentration and time. (Deal-EIS)
W80-03685

COPPER TOXICITY TO THE BAY SCALLOP (ARGOPECTEN IRRADIANS),
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5C.
W80-03689

THE EFFECTS OF THE ANAESTHETIC QUINALDINE ON OXYGEN CONSUMPTION IN AN INTERTIDAL TELEOST BLENNIUS PHOLIS (L.),
Plymouth Polytechnic (England) School of Environmental Sciences.
R. N. Dixon, and P. Milton.
Journal of Fish Biology, Vol 12, p 359-369, 1978. 3 Fig, 7 Tab, 32 Ref.

Descriptors: *Oxygen requirements, *Fish physiology, *Inhibition, *Organic compounds, Teleosts, Chemical properties, Mode of action, Respiration, Water chemistry, Animal metabolism, Marine fish, *Anaesthetics, *Quinaldine, *Blennius, Blennies.

The effects of the anaesthetic quinaldine on oxygen consumption in an intertidal teleost Blennius pholis (L) were investigated. Oxygen consumption generally decreases with increasing quinaldine concentration in environmental water. However, at low concentrations, oxygen consumption of smaller specimens is slightly increased. Generally, smaller specimens have their oxygen consumption affected less by a given quinaldine concentration than do larger specimens, as the former appear to be at less depressed stages of anaesthesia. This is thought to be due to smaller B. pholis becoming saturated with quinaldine more rapidly but simultaneously being afforded more rapid removal, because of their greater relative gill area per unit body volume. The reduction of oxygen consumption at high concentrations of quinaldine is great. (Deal-EIS)
W80-03690

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
R. A. Eagle, P. A. Hardiman, M. G. Norton, and R. S. Nunny.
Ministry of Agriculture, Fisheries & Food, Directorate of Fisheries Research, Fisheries Research Technical Report No 49, ISSN 0308-5589, Lowestoft, 1978. 22 p, 20 Fig, 3 Tab, 1 App, 30 Ref.

Descriptors: *Sludge disposal, *Heavy metals, *Biological communities, Dominant organisms, Bioindicators, Benthic fauna, Path of pollutants, Sewage disposal, *Mercury, *Copper, *Zinc, *Lead, *Nickel, *Chromium, Nutrients, Nitrogen, Phosphorus, Sewage bacteria, Particle size, Bottom sediments, *Species diversity.

The survey of the area in Lyme Bay used for the dumping of sewage sludge shows dispersion processes to be ineffective in preventing accumulations of dumped material in the sediments. Despite the small quantity of sludge dumped (62,000 m3/year) levels of carbon, nitrogen and trace metals such as mercury, copper, zinc, lead, nickel and chromium are significantly elevated in the area most commonly used for dumping. The addition of organic materials by dumping does not appear to have been utilised by any of the benthic species and there is no evidence of enrichment of numbers of individual species or of the number of species. In the zone most contaminated by dumping, however, there appeared to be a slight reduction in the number of species present, caused by the absence of some of the rarer species found in other parts of the survey area. (Deal-EIS)
W80-03696

EFFECTS OF TEMPERATURE AND SALINITY ON PRODUCTION AND HATCHING OF DORMANT EGGS OF ACARTIA CALIFORNIENSIS (COPEPODA) IN AN OREGON ESTUARY,
Oregon State Univ., Corvallis. School of Oceanography.
J. K. Johnson.
Fishery Bulletin, Vol 77, No 3, p 567-584, 1979. 11 Fig, 3 Tab, 32 Ref.

Descriptors: *Copepods, *Hatching, *Inhibition, *Dormancy, Water temperature, Salinity, Toxicity, Growth stages, Growth rates, Embryonic growth stage, Mortality, Seasonal, Zooplankton, Oregon, Yaquina Bay, Estuaries, *Acartia.

Experimental results indicate that induction of dormancy in Acartia californiensis eggs is temperature dependent and occurs below 15C in two ways: (1) Cold adapted females spawn true resting eggs which exhibit major differences in hatching and survival rates from nondormant eggs under similar conditions. (2) Nondormant eggs spawned above 15C may become dormant and have short-term viability at temperatures below 15C. Salinity does not induce dormancy. Hatching results of field-collected resting eggs at naturally occurring temperature-salinity combinations demonstrate that termination of dormancy is also primarily temperature dependent. Salinity, however, regulates rate and success of hatching. In addition, heavy naupliar mortality occurs following hatching at low salinities. Substantial hatching must occur in the field over much of the year. Since subsequent survival and population growth depends on the presence of favorable temperature and salinity conditions, nauplii which hatch during the low salinity winter and spring months in Yaquina Bay must be lost. This phenomenon is viewed as a 'leaky' population diapause. Resting eggs were also demonstrated for Epilabidocera longipedata and Eurytemora affinis, an occurrence previously undescribed in the literature. (Deal-EIS)
W80-03700

EFFECTS OF DAMS AND IMPOUNDMENTS ON MIGRATIONS OF JUVENILE CHINOOK SALMON AND STEELHEAD FROM THE SNAKE RIVER, 1966 TO 1975,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. L. Raymond.
Transactions of the American Fisheries Society, Vol 108, p 505-529, 1979. 7 Fig, 13 Tab, 23 Ref.

Descriptors: *Fish migrations, *Fish barriers, *Columbia River, Chinook salmon, Rainbow trout, Dams, Impoundments, Juvenile growth stage, Mortality, Entrainment, Fish populations, Rivers, Flow rates, Steelhead trout, Pacific salmon, *Snake River.

Migrations of juvenile chinook salmon, Oncorhynchus tshawytscha, and steelhead, Salmo gairdneri, from tributaries of the Snake River were monitored as far downstream as The Dalles Dam on the Columbia River in most years during the period 1966 to 1975. New dams constructed on the Snake River adversely affected survival and delayed migrations of juveniles. Significant losses of juveniles in 1972 and 1973 were directly responsible for record-low returns of adults to the Snake River in 1974 and 1975. Major causes of mortality were passage through turbines at dams, predation, and delays in migration through reservoirs in low-flow years, and prolonged exposure to lethal concentrations of dissolved gases caused by spilling at dams during high-flow years. Migrations of juvenile steelhead were generally later than those of chinook salmon and generally coincided with maximum river discharge. Lack of river runoff in 1973 caused a significant number of steelheads to stop migrating and to hold over in reservoirs. Mortality of chinook salmon and steelhead resulting from new dams has differed with respect to area and cause. Magnitude and composition of seaward migration has changed from 3 to 5 million wild fish in the mid-1960's to 8 to 10 million fish of both wild and hatchery origin in the 1970's. (Deal-EIS)
W80-03701

ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND,
Connecticut Dept. of Environmental Protection, Middlebury.
R. D. Orciari.
Transactions of the American Fisheries Society, Vol 108, p 641-645, 1979. 1 Tab, 21 Ref.

Descriptors: *Shiners, *Resistance, *Rotenone, Adaptation, Pesticide toxicity, Piscicides, Bioassay, Mortality, Fish physiology, Fish populations, Fish management, Connecticut, Ball Pond, *Noxfish(Trade name).

Golden shiners (Notemigonus crysoleucas) generally reinfested Ball Pond, New Fairfield, Connecticut in greater numbers after each of six successive rotenone reclamations carried out from 1957 to 1974. To determine if Ball Pond golden shiners had developed resistance to rotenone, paired bioassays were completed with golden shiners from Ball Pond and from seven comparison ponds. Based on tolerance rations, Ball Pond golden shiners were 4.0-7.1 times more tolerant of synergized and unsynergized formulations of rotenone than were golden shiners from unreclaimed ponds. Fish from Ball Pond were only 2.4 times more tolerant of synergized rotenone than were only 2.4 times more tolerant of synergized rotenone than were golden shiners from a pond reclaimed once with synergized rotenone in 1974. Golden shiners from comparison ponds also succumbed earlier to the effects of both rotenone formulations than did fish from Ball Pond. These findings suggest that Ball Pond golden shiners developed increased resistance to rotenone through the selective forces of reclamation. (Deal-EIS)
W80-03702

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.
J. J. Dodson, and C. I. Mayfield.
Transactions of the American Fisheries Society, Vol 108, p 632-640, 1979. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *2,4-D, *Pesticide toxicity, *Rainbow trout, *Rheotropism, Fish physiology, Animal metabolism, Pesticide kinetics, Herbicides, Chlorinated hydrocarbon pesticides, Fish behavior, Lethal limit, Pesticide residues, Bioassay, *Aqua-Kleen(Trade Name).

The rheotropic response of rainbow trout (Salmo gairdneri) to a water current, simulated by a striped background moving past the fish, was observed following 24-hour exposures to field application concentrations of the aquatic herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) butoxyethanol ester and its commercial formulation Aqua-Kleen (Trade Name). Toxicological modification of rhotropism occurred that would in nature lead to an increased incidence of downstream movement. With increasing concentrations of Aqua-Kleen, the rheotropic response became more variable. As concentrations approached lethal levels, rainbow trout became extremely lethargic and could not avoid capture. Aqua-Kleen was lethal to rainbow trout at concentrations approximately twice the suggested field application level. The ester was taken up rapidly by fish and hydrolyzed to 2,4-D that was secreted back into the water. (Deal-EIS)
W80-03703

THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE INTERACTIONS OF CHLORINE, ELEVATED TEMPERATURE, AND EXPOSURE DURATION FOR GRASS SHRIMP, PALAEMONETES PUGIO,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
L. W. Hall, Jr., D. T. Burton, and S. L. Margrey.
Transactions of the American Fisheries Society, Vol 108, p 626-631, 1979. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Water temperature, *Chlorine, *Adaptation, *Shrimp, Chlorination, Heated water, Thermal stress, Powerplants, Toxicity, Mortality, Bioassay, Mathematical models, Animal physiology, *Acclimation.

The effect of 15 and 27C acclimation temperatures on interactions of chlorine, elevated temperature (Delta T), and exposure duration was assessed for the grass shrimp. Test organisms were exposed to total residual chlorine (TRC) concentrations of 0.00, 0.15, and 0.30 mg/liter in combination with Delta T's of 2, 6, and 10C above acclimation temperature and exposure periods of 0.08, 2.0 and 4.0 hours. Chlorine concentrations were decayed over a 1 - 1.5-hour period to D0.01 mg/liter TRC and temperatures were decayed over a 4-hour period to 2C above acclimation. Mortality observations were conducted for 96 hours; however, most of the deaths occurred 36 hours after exposure to the three test variables. A percent mortality model for grass shrimp acclimated to 27C showed (1) the response to chlorine concentration alone and Delta T alone was proportional to the square root of either variable; (2) the exposure duration effect was linear; and (3) no second-order interactions occurred among the variables tested. The model for grass shrimp acclimated to 15C showed (1) Delta T had no effect; (2) the response to chlorine concentration was the dominant factor; and (3) there existed a two-way linear interaction between chlorine concentration and exposure duration. (Deal-EIS)
W80-03704

SEMICONTINUOUS OUTDOOR CULTIVATION OF SCENEDESMUS ACUTUS IN WASTE WATER,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
K. Livansky, K. Veber, and B. Prokes.
Acta Hydrochimica et Hydrobiologica, Vol 7, No 4, p 369-378, 1979. 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Scenedesmus, *Waste water treatment, *Microbial degradation, Chlorophyta, Aquatic algae, Sewage treatment, Farm wastes, Domestic wastes, Productivity, Biomass, Nutrients, Phosphorus, Nitrogen, Growth rates, Aquiculture.

The algae were cultivated in an outdoor cultivation unit in waste water from a sewage treatment plant processing city sewage and largescale hoggery effluent. The cultivation area (2 sq m) had a slant of 3% and the suspension layer thickness was about 5 cm. The total suspension volume in the cultivation device was 150 l. Mass balance served us for derivation of formulas for the average rate of algal biomass production and for the extent of nutrient removal from waste water. Experiments showed a considerable effect of dilution rate on individual parameters in these formulas. The removal of nitrogen and phosphorus is optimal at a dilution rate of 0.3/day whereas optimum biomass production lies at about 0.1/day. The nitrogen and phosphorus yield coefficient Y (g biomass/g element) are practically identical, both of them depending on dilution rate. The effect of the dilution rate on other characteristics of the effluent water has not yet been unambiguously proved. The results of bacteriological and mycological examinations and of the chemical analysis of resulting algal biomass are presented. (Deal-EIS)

W80-03705

STUDIES ON THE EFFECTS OF ACIDIC MEDIUM ON THE FRY OF CYPRINUS CARPIO,
Holkar Science Coll., Indore (India). Dept. of Zoology.
R. S. Shrivastava, and P. Dwivedi.
Acta Hydrochimica et hydrobiologica, Vol 7, No 4, p 421-430, 1979. 6 Fig, 1 Tab, 20 Ref.

Descriptors: *Acids, *Toxicity, *Fry, *Carp, Fish eggs, Growth stages, Animal growth, Hatching, Cytological studies, Biological membranes, Mode of action, Bioassay, Lethal limit, Chemical wastes, Industrial wastes, Hydrochloric acid, *Teratogens.

The effects of acidic medium on the fry of Cyprinus carpio have been studied. The eggs were put in various concentrations of HCl ranging from 0.0025 ppm to 0.0500 ppm. One specimen from each experimental group was sacrificed for histological studies every week. It was found that when the fry were kept in the acidic medium the following changes took place. The nucleus became inconspicuous and the cell wall became disorganised. The muscle layers of gut wall became indistinct and disorganised to some extent. The epithelial lining of the gut was partially destroyed. Vacuolation in the connective tissue of gut was seen due to destruction of some of the cells. Hepatic cells of the liver were destroyed at various spots to a varying degree. A comparative study of results showed that the percentage of hatching is inversely proportional to the strength of pollutant (HCl). The LD-50 period of fry is inversely related to the strength of HCl in ppm. (Deal-EIS)
W80-03706

MUTAGENICITY OF FLUORENE DERIVATIVES: A PROPOSED MECHANISM,
Massachusetts Univ., Amherst. Dept. of Botany.
D. E. Levin, W. S. Barnes, and E. Klekowski.
Mutation Research Vol 63; p 1-10 1979. 3 Fig, 2 Tab, 27 Ref. OWRT B-053-MASS (6).

Descriptors: *Mutagens, *Fluorene derivatives, *Salmonella, Water pollution, Pollutant identification.

Several derivatives of fluorene, a tricyclic, organic molecule, have been found to induce both frameshift mutations and base-pair substitutions in Salmonella typhimurium strains developed by Ames. Comparisons of the mutagenic potency of these derivatives for several strains of Salmonella suggest the importance of a carbonyl group substituted at the carbon-9 position of mutagenic derivatives, with respect to mutagenic potency. In this study, a feasible mechanism for the interaction of mutagenic fluorene derivatives with deoxyribonucleic acid is presented. This mechanism requres the interaction of the mutagenic molecule with carbon-8 of guanine and a second concurrent interaction with the C-4 amino group of an adjacent cytosine residue. (Godfrey-Mass)
W80-03745

MUTAGENS IN A RIVER HEAVILY POLLUTED WITH PAPER RECYCLING WASTES: RESULTS OF FIELD AND LABORATORY MUTAGEN ASSAYS,
Massachusetts Univ., Amherst. Dept. of Botany.
E. Klekowski, and D. E. Levin.
Environmental Mutagenesis Vol 1; p 209-219, 1979. 3 Tab, 19 Ref. OWRT B-053-MASS (7).

Descriptors: *Paper recycling, *Mutagens, *Water pollution, *Industrial wastes, *Pulp and paper industry, Environmental effects, Biota, Ecotypes, Pollutant identification.

A natural population of the fern Osmunda regalis growing in a river heavily polluted with paper recycling wastes had a high incidence of chromosome mutations. This population was monitored for four years for the frequency of two-break chromosome mutations. These mutations were postzygotic in origin and suggested the presence of mutagens in the river water. The fern population is downstream from the outfalls of a paper recycling mill, which was discharging 13.3 X 10 to the 6th power liters of untreated paper recycling waste per day. In 1977 a waste-water-treatment facility was constructed to remove the solid waste previously discharged into the river. This facility generates 69,300 kg of solid waste daily, which is taken to a landfill. Periodic samples of this solid waste were collected from the waste-treatment facility in the summer of 1978, extracted with various solvents, and the extracts tested for mutagenic activity with the Salmonella/mammalian microsome mutagenicity test (Ames et al, 1975). A majority of the solid waste samples contained mutagenic materials, but in all cases S-9 activation was required for mutagenic activity. The samples also were assayed with the soybean mitotic crossing-over assay (Vig, 1975). Four out of six samples were positive. These results document the presence of mutagens in the solids waste generated by a paper recycling industry and the genetic impact of these mutagens on the local biota. (Godfrey-Mass)
W80-03746

AN EMPIRICAL MODEL FOR PHYSICAL PARAMETERS OF RECENT SEDIMENTARY DEPOSITS OF LAKE EKOLN AND LAKE VANERN,
National Swedish Protection Board, Uppsala.
L. Hakanson.
Vatten, Vol 33, No 3, p 266-289, 1977. 27 Fig, 5 Tab, 33 Ref.

Descriptors: *Sediments, *Sedimentation, *Lake Ekoln, Sweden, *Interstitial water, *Lake Vanern, Sweden, Organic matter, Density, Depth, Particle size, Fetch, Equations, Erosion, Erosion rates, Lake beds, Curves, Correlation analysis, Compaction, Sedimentation rates.

In Lakes Ekoln and Vanern, Sweden, the internal physical sediment status of the biologically active sediment layer, indicated by water content, organic content, bulk density, inorganic matter density, grain size, sediment compaction and sediment depth, can be described by general empirical equations. Furthermore, the model shows that water content correlates with all internal variables. Internal sediment status also correlates with external governing parameters such as effective fetch, water depth, slope and distance from river mouth. This indicates that the bottom dynamic situation may be determined before sediment samples have been collected. This approach makes it possible to predict areal distribution of erosion, transportation and accumulation zones. Sediment samples must be collected to establish the physical status of accumulation bottom sediments. After empirical constants are determined, the gross variation of all internal sediment parameters throughout the active layer within accumulation zones may be calculated. Lakes Ekoln and Vanern differ significantly in terms of size, trophic status, bottom fauna and alloctonous influence. Lake Ekoln has 19 sq km area, 38.3 m maximum depth and is eutrophic. Lake Vanern has 5,650 sq km area, 106 m maximum depth and is oligotrophic. Work focuses on biologically active deposits within accumulation zones. (Danovich-Wisconsin)
W80-03790

VERY SIMPLE MODEL OF THE INITIAL STAGE OF OLIGOTROPHIC-EUTROPHIC SUCCESSION. IN BODIES OF WATER,
Moscow State Univ., (USSR).
V. V. Alekseev, and M. S. Polyakova.
The Soviet Journal of Ecology, Vol 9, No 1, p 1-5, January-February, 1978, 2 Fig, 5 Ref. Translated from Ekologiya, No 1, p 5-10, January-February, 1978.

Descriptors: *Succession, *Mathematical models, *Ecosystems, *Speication, Eutrophication, Oligotrophy, Biological communities, Biomass, Nutrients, Nitrogen, Phosphorus, Equations, Kinetics, Nutrient loading, Trophic level, Invasion, Food abundance, Food chains, Foods, Competition.

A succession process model in oligotrophic water bodies shows that increasing total mass of system-limiting biogenic elements increases the number of species. However, the maximal number of species in the climatic community differs; it is maximal when consumers are mainly specialized for a particular diet. If the character of trophic connections between species is known, matter circulation schemes can be compiled in certain limiting ecosystems containing all these species. Ecosystems biomass increase rates are determined by biogenic elements present in the ecologic minimum. In water ecosystems these biogenic elements are usually nitrogen or phosphorus. Dynamic model variables are ecosystem component masses such as species biomass. The model consists of differential equations describing ecosystem kinetics. It can predict tendencies taking place during natural or artificial species introduction. On introduction, one specie may be supplanted by another. Adaptation to abiotic environmental factors is exceptionally important for the immigrant species survival; however, the immigrant's biotic environment, principally food reserves and enemies, are also important to attain high abundance. The model predicts a given species ability to survive approximately, if trophic system connections between species and quantitative estimates of these connections are known. (Danovich-Wisconsin)
W80-03792

THE DISTRIBUTION OF ALGAL EPIPHYTES ON MACROPHYTE HOSTS OFFSHORE FROM LA PARGUERA, PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
For primary bibliographic entry see Field 5C.
W80-03797

BODY SIZE AND FEEDING ECOLOGY AS ALTERNATIVES TO TAXONOMY FOR THE STUDY OF LIMNETIC ZOOPLANKTON COMMUNITY STRUCTURE,
Erindale Coll., (Ontario). Dept. of Zoology.
W. G. Sprules, and L. B. Holtby.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1354-1363, November 1979. 1 Fig, 7 Tab, 51 Ref.

Descriptors: *Zooplankton, *Systematics, *Biological communities, *Size, *Food habits, *Ecotypes, Lakes, Bruce Peninsula, Ontario, Energy, Energy transfer, Food webs, Ecology, Ecosystems, Regression analysis, Correlation analysis, Dominant organisms, Food chains, Southeast Asia, Sri Lanka, Tropical regions, Canada.

Analysis of methods for characterizing limnetic zooplankton community structure in 44 water bodies of Bruce Peninsula, Ontario July and August 1975 show that in comparison with taxonomy, ecological and image analysis characterization reflect zooplankton community features better in terms of efficiency and energy flow. While patterns in taxonomic community structure are of interest, characterizations of zooplankton associations on the basis of body size and feeding ecology are of greater use because (1) they more closely reflect zooplankton community features which are related to efficiency and energy flow through pelagic ecosystems; (2) emphasis of simpler, more ecologically significant size characteristics results in stronger relations to lake limnological features; (3) they provide more informative comparisons of plankton communities from disparate zoogeographic regions; and (4) they require less money, expertise and time in community data acquisition. Excepting major equipment capital costs and presuming access to an image analyzer, individual sample processing time for image analysis is 25% that for ecological analysis which is 33% that for taxonomic analysis. Furthermore, body size-feeding ecology analysis or image analysis zooplankton associations more strongly correlate statistically to lake morphometric and hydrological properties. Body size-feeding ecology characterizations also provide more useful functional insights than taxonomically based ones when comparing zooplankton communities from Bruce Peninsula, Ontario and southeast Asia, particularly Sri Lanka. (Danovich-Wisconsin)
W80-03815

ASSESSMENT OF AQUATIC WEED PROBLEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03826

TAXONOMIC CHARACTERISTICS OF AQUATIC PLANTS FROM THE ALIMENTARY TRACT OF GRASS CARP,
Florida State Game and Fresh Water Fish Commission, Eustis. Eustis Fisheries Research Lab.
For primary bibliographic entry see Field 4A.
W80-03831

5B. Sources Of Pollution

ENTEROVIRUS INACTIVATION IN SOIL AND STRUCTURAL CHANGES ASSOCIATED WITH THE INACTIVATION OF SOIL-BOUND VIRUSES,
New Mexico State Univ., Las Cruces. Dept. of Biology.
For primary bibliographic entry see Field 3C.
W80-03603

RIVER-QUALITY ASSESSMENTS.
Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. American Water Resources Association, St Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, 1978. 190 p, Greeson, P.E., Editor.

Descriptors: *Water quality, *River basins, *Conferences, *Oregon, *Georgia, *Colorado, *Wyoming, *On-site investigations, Water resources, Water pollution, Water management(Applied), Water quality control, Low-flow augmentation, Water treatment, Water pollution sources, Erosion, Water properties, Dissolved oxygen, Biochemical oxygen demand, Thermal water, Model studies, Rivers, Watersheds(Basins), *Willamette River Basin(OR), *Chattahoochee River Basin(GA), *Yampa River Basin(CO), Secondary treatment, River-quality assessments, Pilot studies.

River-quality assessments were made during pilot studies on the Willamette River basin in Oregon, the Chattahoochee River basin in Georgia, and the Yampa River basin in Colorado and Wyoming. The ten papers presented at the symposium reported on these pilot studies in the broad subject areas of Concepts of River-Quality Assessments and Selected Methods for Addressing River-Quality Problems. (See W80-03607 thru W80-03616) (Humphreys-ISWS)
W80-03606

RIVER-QUALITY ASSESSMENT: CONCEPT, FRAMEWORK, AND APPLICATION IN THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR.
For primary bibliographic entry see Field 6B.
W80-03608

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
R. N. Cherry, R. E. Faye, J. K. Stamer, and R. L. Kleckner.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 22-42, 1978. 15 Fig, 4 Tab, 2 Ref.

Descriptors: *Water quality, *River basins, *Georgia, *On-site investigations, Water pollution sources, Urbanization, Pollutants, Water pollution, River regulation, Data collections, Biological communities, Water utilization, Dissolved solids, Dissolved oxygen, Water temperature, Phytoplankton, Algae, Sediments, Discharge(Water), Land use, Thermal water, Water supply, Hydroelectric power, Hydrology, *Chattahoochee River Basin(GA), River-quality assessment.

The purpose of this report was to present a general description of the area, present and future water uses in the basin, and findings of the study relating to water-quality problems. Urbanization and hydropower releases have a pronounced effect on the quality of the waters of the Chattahoochee River. Loads of total and dissolved constituents increase exponentially with increases in urbanization within the basin. Urban point and nonpoint waste sources contribute most of the dissolved solids and large amounts of the suspended loads to the river. Annually, point sources contribute about 53% of the total phosphorus and 47% of the total nitrogen loads determined at a station 30 miles downstream of Atlanta. Nonpoint sources contributed 78% of the dissolved solids and 72 to 89% of the heavy metal load. Point source discharges of carbonaceous and nitrogenous loads contribute about equally to low dissolved oxygen concentrations (4.6 mg/l) in the river during low flow. Heat loads from thermoelectric generating facilities increase the rate at which the dissolved oxygen in the river is depleted. Hydropower releases and regulation of flows from Buford Dam and Morgan Falls reduce the frequency and magnitude of high and low flows of the river. During low flow periods the net effect of the regulated flow is to cool the waters of the Chattahoochee River and dilute the waste discharges from urban areas. Sediment yields in the basin are primarily a function of drainage area, rainfall, and land use. (See also W80-03606) (Humphreys-ISWS)
W80-03609

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
W. G. Hines, and D. A. Rickert.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 65-72, 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Water quality, *Monitoring, *Rivers, *Hydrologic aspects, Water pollution, Planning, Management, Analysis, Streamflow, Water temperature, Channel morphology, Salinity, Toxicity, Algae, Dissolved oxygen, Water sampling, Analytical techniques, Methodology.

River-quality planning and management programs have been hampered by a general inability to analyze and document pollution trends and cause-effect relations. River-quality data programs historically have been based on routine monitoring approaches that provide poor capability for separating those quality variations caused by the natural hydrologic regimen from those caused by pollution loads. An outline for a new conceptual framework was proposed as a basis for improving the interpretive utility of river-quality data programs. The framework is based on (1) a hydrologic analysis focusing on streamflow and water temperature patterns and channel morphology characteristics, (2) the use of a multiple steady-state concept to 'keep track' of seasonal quality variations and to provide a guide for the timing of (3) intensive, synoptic sampling studies (in lieu of routine monitoring) made during the most critical times and pollution-prone river reaches. Viewed from the broadest perspective, a commitment to the program outlined would involve a shift to a flexible, opportunistic approach, and away from a rigidly structured routine approach. Importantly, however, the results from many different river systems would be bound by the common conceptual framework offered by the consideration of river hydrology and its intimate relation to the temporal and spatial form of each river-quality process and problem. (See also W80-03606) (Humphreys-ISWS)
W80-03611

DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W80-03612

ALGAL GROWTH POTENTIAL--LOWER WILLAMETTE RIVER, OREGON,
Portland State Univ., OR. Dept. of Biology.
R. Petersen.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 101-124, 1978. 14 Fig, 1 Tab, 36 Ref.

Descriptors: *Water quality, *Aquatic life, *Rivers, *Oregon, Ecosystems, On-site investigation, On-site data collections, Aquatic environment, Phytoplankton, Nutrients, Diatoms, Plankton, Primary productivity, Silica, Nitrates, Nitrogen, Phosphorus, Water sampling, Laboratory tests, Spatial distribution, Temporal distribution, Dissolved oxygen, Algae, *Willamette River(OR).

The growth of planktonic algae was investigated in the lower reaches of the Willamette River during 1973 and 1974. Primary productivity was not high, and the dominant species observed were diatoms. Orthophosphate, silica, and nitrate plus ammonia were present in concentrations well above levels that are considered limiting to algal growth. High inorganic turbidity and a relatively deep mixed layer evidently limited algal growth in the lower reaches of the Willamette River. (See also W80-03606) (Humphreys-ISWS).
W80-03614

THERMAL MODELING OF HIGHLY TRANSIENT FLOWS IN THE CHATTAHOOCHEE RIVER NEAR ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS.
For primary bibliographic entry see Field 2E.
W80-03615

TRACE ELEMENT LOADING OF SOUTHERN LAKE MICHIGAN BY DRY DEPOSITION OF ATMOSPHERIC AEROSOL,
Governors State Univ., Park Forest South, IL. Coll. of Environmental and Applied Sciences.
D. A. Dolske, and H. Sievering.
Water, Air, and Soil Pollution, Vol 12, No 4, p 485-502, November 1979. 2 Fig, 9 Tab, 29 Ref. EPA R00530101.

Descriptors: *Trace elements, *Lake Michigan, *Aerosols, *Water pollution sources, Metals, Chemicals, Sampling, Monitoring, Chemical analysis, Air pollution, Water pollution, Winds, Air temperature, Water temperature, Currents(Water), Pollutants, Path of pollutants.

Aerosol samples and meteorological data were collected at a mid-southern Lake Michigan site (87 deg 00 min W, 42 deg 00 min N) from May through September 1977. Hi-volume samplers with cellulose fiber filters and a digital meteorological data recording system were operated on board the U.S. EPA's R/V Roger R. Simons during four intensive sampling periods. Aerosol samples were analyzed by atomic absorption spectroscopy for seventeen trace elements. A diabatic drag coefficient method was used to determine aerosol deposition velocity (nu sub d) overlake. A mean nu sub d of 0.5 cm/s was found for the aerosol diameters between 0.1 and 2.0 micrometers. By relating the observed trace element concentrations and nu sub d to a long-term climatological record, annual dry deposition loadings to the southern basin for nine elements were estimated. For four elements, Fe, Mn, Pb, and Zn, dry deposition loadings to the southern basin alone of at least 500000, 30000, 250000, and 100000 kg/yr were found. For Fe and Mn, these loadings represent about 15% of the total of all inputs to Lake Michigan. For Zn and Pb, about one-third to one-half of the annual loading from all sources is from dry deposition of atmospheric aerosol. (Sims-ISWS)
W80-03621

ON THE VALUE OF SOIL COLUMNS FOR ASSESSING THE TRANSPORT PATTERN OF VIRUSES THROUGH SOILS: A CRITICAL OUTLOOK,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
G. Bitton, J. M. Davidson, and S. R. Farrah.
Water, Air, and Soil Pollution, Vol 12, No 4, p

449-457, November 1979. 2 Tab, 30 Ref.

Descriptors: *Soils, *Viruses, *Path of pollutants, *Waste disposal, Effluents, Sewage effluents, Sewage sludge, Pollutants, Water pollution, Soil contamination, Soil water, Groundwater, Soil water movement, Laboratory tests, On-site investigations, Monitoring, Reviews.

The U.S. Water Pollution Control Act Amendment of 1972 (PL 92-500) has made land disposal of wastewater effluents and residuals a viable and attractive alternative. Land spreading of wastewater effluents and residuals has many advantages, including the addition of plant nutrients, water conservation, improvement of soil physical properties, and increased soil organic matter. Public health risks associated with land disposal of wastes containing human pathogens can be assessed only through a thorough examination of the survival and transport pattern of these pathogens through soils. This topic has been thoroughly covered in recent reviews. In this review, the authors were primarily concerned with a critical examination of the various methods frequently used to assess soils' potential to retain viruses. Knowledge concerning the transport pattern of viruses through soils can be gained through field monitoring of these infectious particles in wastewater effluents, sludges, soils and groundwater, and/or through soil column experiments. The latter have been criticized, and our purpose was to examine these criticisms and suggest, if necessary, some alternate solutions. Furthermore, the authors reviewed the practical information gained through soil column studies and examined, with the aid of examples of land application sites across the country, the relationship between laboratory and field studies. (Sims-ISWS)
W80-03622

INCIDENTS OF ELEVATED NITRATE IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Toronto (Ontario).
K. C. Heidorn.
Water, Air, and Soil Pollution, Vol 12, No 4, p 417-429, November 1979. 11 Fig, 2 Tab, 19 Ref.

Descriptors: *Nitrates, *Air pollution, *Path of pollutants, *Canada, *Great Lakes, Water pollution sources, Nutrients, Acids, Nitrogen compounds, Weather, Winds, Meteorology, *Ontario.

A study of nitrate in suspended particulate in the lower Great Lakes region of southern Ontario, Canada, during the period 1976-1977 has indicated that elevated levels (in excess of 9.9 micrograms/cu m) occur simultaneously across the region on certain days. These days most frequently fall within the cold-season months of October to March. The most common weather situation on these days is the presence of an anticyclone over or to the east of southern Ontario. Case studies of three periods in early 1977 during which widespread elevated nitrates occurred showed nitrate levels to be dependent upon the previous history of the air mass. When back trajectories showed that the air mass had previously moved across the lower Great Lakes, nitrate levels were high. Low nitrate levels were most common when the air mass had moved across the upper Great Lakes. The low variability of nitrate concentration among the monitoring network and similar history of air mass movement indicates that long range transport is, in part, responsible for elevated ambient nitrate levels. (Sims-ISWS)
W80-03623

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-03643

CONTRIBUTIONS OF URBAN LAND USE TO STREAM WATER QUALITY,
Delaware Univ., Newark. Dept. of Civil Engineering.
D. L. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151178, Price codes: A08 in paper copy, A01 in microfiche. MS Thesis, 1979, 139 p, 80 Ref. OWRT B-018-DEL(2), 14-34-0001-8070.

Descriptors: *Urban runoff, *Path of pollutants, *Lead, Cadmium, Streams, Inflow, Surface runoff, Storm water, Delaware, *Christiana River(Del).

The impact of urban runoff on stream water quality with respect to cadmium and lead in both the particulate and liquid phase, was examined for the Christiana River in the Newark, Delaware area. Five stations were selected, each depicting a different degree of urbanization. Measured concentrations were correlated with stream volumetric flow rates so that storm discharge values could be calculated. Four complete storm events were sampled at appropriate time intervals with results indicating that lead pollution originated from surface stormwater runoff. Rainwater pH demonstrated a temporal variation within a storm event such that increasing pH during a storm controlled the liquid or solid phase concentrations of lead, but cadmium concentrations did not appear to exceed any possible solubility of pH-controlled precipitates. Stream sediment examination indicated primarily that lead was associated with the sediment solids while cadmium remained soluble. Analysis of stream sediments and soils at the sampling stations indicated that these solids, suspended during storm events possess significant adsorption capacity. Modeling efforts with the resulting data indicate the hydraulic dispersion and stochastic models were most appropriate for describing the stream response to storm events.
W80-03644

EFFECT OF SOME CHEMICAL AGENTS ON THE UPTAKE OF 32P AND 65ZN BY MACROPHYTES IN THE BLACK SEA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
L. I. Rozhanskaya, I. V. Demina, and A. V. Parkhomenko.
Hydrobiological Journal, Vol 14, No 3, p 74-76, 1978. 2 Fig, 10 Ref.

Descriptors: *Absorption, *Algae, *Phosphorus, *Zinc, *Phenols, Zinc radioisotopes, Phosphorus radioisotopes, Tracers, Radiochemical analysis, Path of pollutants, Chemical properties, Phenols, Organic compounds, *Cystoseira, Phenol, Hydroquinone, Fluoroglucin.

Data are presented on the uptake of 32p by the Black Sea alga Cystoseira barbata in the presence of compounds with one (phenol), two (hydroquinone) and three (fluoroglucin) hydroxy groups. Phenol and hydroquinone stimulate the uptake of 32p in sea water. Fluroglucin first inhibits its uptake, then later stimulates it. The uptake of 65Zn in the presence of hydrogen sulfide was likewise inhibited initially, but later facilitated. (Deal-EIS)
W80-03662

THE ABSORPTION OF DDT BY VASCULAR AQUATIC PLANTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. I. Merezhko, and T. I. Shokod'ko.
Hydrobiological Journal, Vol 14, No 3, p 68-73, 1978. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Rooted aquatic plants, *Absorption, *DDT, Pesticide kinetics, Pesticide toxicity, DDD, DDE, Chlorinated hydrocarbon pesticides, Root systems, Plant physiology, Tracers, Radiochemical analysis, Marsh plants, *Bioaccumulation, *Tissue analysis.

Pondweed and reeds absorb and accumulate significant quantities of DDT. The stability of the mechanism by which pondweed absorbs this pesticide--which we can judge by considering changes in the curves which represent the absorption of DDT-14C as a function of concentration and exposure time--enable us to postulate that this plant has no active mechanism for regulating DDT absorption. Its accumulation of the insecticide is governed by the latter's concentration and by the time the plant is exposed to it; absorption continues until it kills the plant. In reeds, an active protective mechanism was found which responds to high concentrations of DDT in the environment. This mechanism takes the form of an accumulation of large quantities of DDT by the root system so that large quantities of DDT do not reach the stems and leaves. Changes in the ratios of DDT, DDD and DDE in the water, roots and leaves indicate that partial dechlorination of the pesticide occurs in growing reeds. This suggests that reeds play a substantial role in the processes by which bodies of water cleanse themselves of DDT residues. (Deal-EIS)
W80-03663

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS TRANSFERRED TO FISH FROM PETROLEUM SUSPENSION BY MASS CHROMATOGRAPHY,
Okayama Univ. (Japan). Dept. of Public Hygiene.
M. Ogata, and Y. Miyake.
Water Research, Vol 13, p 1179-1185, 1979. 4 Fig, 1 Tab, 7 Ref.

Descriptors: *Pollutant identification, *Oil pollution, *Eels, Sulfur compounds, Chemical analysis, Oil, Gas chromatography, Mass spectrometry, Organic compounds, Path of pollutants, Chemical properties, Monitoring, *Tissue analysis, *Crude oil, *Naphthalenes, *Benzothiophenes, *Dibenzothiophenes.

The authors attempted to select organic sulfur compounds usually contained in crude oil as markers of oil pollution in fish. To confirm this, eels (Anguilla japonica) were maintained in a controlled laboratory environment in water with suspensions of crude oil. Gas chromatography-mass spectrometry and mass chromatography of eel flesh extract showed the presence of organic sulfur compounds of alkyl-(from mono- to pentamethyl) benzothiophenes, dibenzothiophene and alkyl-(from mono- to trimethyl) dibenzothiophene and of other organic sulfur compounds of alkyl-(from mono- to pentamethyl) naphthalene. Alkyl benzothiophenes or alkyl dibenzothiophenes of lower carbon numbers were more easily transferred to eel than those of higher carbon numbers. (Deal-EIS)
W80-03671

QUANTITATIVE EXTRACTION OF CHLORINATED ORGANIC PESTICIDES AND POLYCHLORINATED BIPHENYLS FROM FISH ORGANS AND TISSUES,
Institute of Experimental Meteorology Obrinsk (USSR).
For primary bibliographic entry see Field 5A.
W80-03674

EXTRACTION AND ACCUMULATION OF 210PB BY AQUATIC ORGANISMS IN LAKES,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
R. F. Dusauskene-Duz, and G. G. Polikarpov.
Hydrobiological Journal, Vol 14, No 3, p 62-67, 1978. 1 Fig, 7 Tab, 17 Ref.

Descriptors: *Lead radioisotopes, *Absorption, *Aquatic algae, *Aquatic plants, Lead, Heavy metals, Radioecology, Radiochemical analysis, Tracers, Lakes, Plant physiology, Metabolism, Path of pollutants, *Tissue analysis, *Bioaccumulation, *Chara, Potamogeton.

Studies of four lakes with different natural thermal profiles showed that the concentration of Pb-210 in the water is independent of depth, and averages 0.26 picocuries per liter. Algae accumulate Pb-210 more actively and in larger amounts than do macrophytes. The accumulation coefficients (AC) are 650 and 300, respectively. The alga with the highest AC (1600) for this radioisotope is Chara contraria. Among macrophytes the highest AC (430) is found in a group of Potamogetonaceae. Extraction of 210Pb from water depends on the plants' absorption capacity and biomass. (Deal-EIS)

W80-03677

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN, II ROLE OF WATERCHESTNUT IN PRIMARY PRODUCTIVITY AND NUTRIENT UPTAKE,
Tsukuba Univ., Sakuramura Ibaraki (Japan). Inst. of Biological Sciences.
T. Tsuchiya, and H. Iwaki.
Water, Air, and Soil Pollution, Vol 12, p 503-510, 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Plant physiology, *Nutrients, *Photosynthesis, Primary productivity, Trophic level, Eutrophication, Lakes, Aquatic plants, Rooted aquatic plants, Root systems, Growth rates, Inhibition, Cyanophyta, Metabolism, *Waterchestnut, *Trapa.

Waterchestnut was shown to be one of the most efficient agents to yield photosynthetic products among aquatic plants in littoral vegetation. Though the plant can be an agent to remove nutrients in agricultural and domestic wastes directly through its waterroots to some extent, waterchestnut plays a great role in removing nutrients through its roots from lake sediments to water-column of the lake. Waterchestnut can be choked to death when its leaves are covered completely by the heavy blue-green algal bloom typical in hypereutrophic lakes. (Deal-EIS)
W80-03681

MERCURY CIRCULATION IN AQUATIC ENVIRONMENT. PART 2: METABOLISM OF METHYL AND PHENYL MERCURY IN PHYTOPLANKTON,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia).
B. Havlik, J. Stary, J. Prasilova, K. Kratzer, and J. Hanusova.
Acta Hydrochimica et Hydrobiologica, Vol 7, No 4, p 401-408, 1979. 6 Fig, 28 Ref.

Descriptors: *Mercury, *Phytoplankton, *Metabolism, Chlorella, Scenedesmus, Cyanophyta, Aquatic algae, Path of pollutants, Radiochemical analysis, Tracers, Absorption, Radioisotopes, *Biotransformation, *Methylmercury, *Bioaccumulation, Inorganic mercury, Detoxification.

The biotransformation of phenyl and methyl mercury chloride was studied in experiments with planktonic algae Chlorella kessleri, Scenedesmus obliquus and blue-green algae Microcystis incerta. To algal cultures cultivated in an inorganic medium the labelled phenyl or methyl mercury hydroxide was added separately in the phase of the logarithmic growth, the resultant concentration being (3.2 times 10 to the minus 7th power). In intervals of 0, 1, 3, 7, 10 and 14 days samples of the algae and medium were analysed for the total amount of mercury and for the presence of phenyl or methyl mercury. It was found that both methyl and phenyl mercury had accumulated very rapidly in the algae and that up to 70% of 203Hg added was present in the algae during the first 72 hours of the experiment. From the 2nd day onwards, however, methyl and phenyl mercury changed rapidly into inorganic mercury so that by the end of the experiment almost all of the mercury present in algae and the medium was in the form of inorganic mercury. (Deal-EIS)
W80-03682

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
For primary bibliographic entry see Field 5A.
W80-03683

TRANSFER OF 14C-TOLUENE FROM MOSQUITO LARVAE TO BLUEGILL SUNFISH,
Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
W. O. Berry, and J. W. Fisher.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 733-736, 1979. 1 Tab, 6 Ref.

Descriptors: *Food chains, *Path of pollutants, *Sunfishes, *Mosquitoes, Radiochemical analysis, Tracers, Larval growth stage, Fish food organisms, Absorption, Oil, *Toluene, *Bioaccumulation, *Tissue analysis.

Fourth-instar larvae of the mosquito Aedes aegypti were exposed to a toluene-water solution for 3h, then fed to bluegill sunfish under controlled conditions. At selected time periods (1,4,8,24 and 48 hrs) 5 fish were sacrificed and analyzed. With the exception of the stomach and intestine, there was no difference in the concentration of 14C-toluene in the organs of experimental and control fish. The accumulation of toluene in stomach and intestine would be expected as the ingested, toluene-treated larvae pass along the alimentary canal. These results support the contention that bioaccumulation of chemicals within aquatic food chains is insignificant when compared to accumulation directly from water. (Deal-EIS)
W80-03686

MOBILIZATION OF ORGANOCHLORINES FROM FEMALE LIPID TISSUE AND TRANSPLACENTAL TRANSFER TO FETUS IN A HARBOUR PORPOISE (PHOCOENA PHOCOENA) IN A CONTAMINATED AREA,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, and M. Th. J. Hillebrand.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 728-732, 1979. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Pesticide residues, *Pesticide kinetics, *Marine animals, Mammals, Polychlorinated biphenyls, DDT, DDD, DDE, Dieldrin, Chlorinated hydrocarbon pesticides, Path of pollutants, Animal physiology, Animal metabolism, *Marine mammals, *Porpoise, *Tissue analysis, *Bioaccumulation, Harbor porpoise, Netherlands.

The fetus of a harbour porpoise from a female stranded on a beach was analyzed for organochlorine content. The highest concentrations of organochlorines are those of PCBs, DDT and dieldrin. The residue concentrations in the fetus are on the same order as the high values detected in adult specimens found dead along the Dutch coast. The results suggest that a significant fraction of the body burden of organochlorines in the female can be transferred to the fetus. (Deal-EIS)
W80-03687

ORGANOCHLORINE, FLUORINE, AND HEAVY-METAL LEVELS IN SOME BIRDS FROM NEW ZEALAND ESTUARIES,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
J. C. Turner, S. R. B. Solly, J. C. M. Mol-Krijnen, and V. Shanks.
New Zealand Journal of Science, Vol 21, p 99-102, 1978. 1 Tab, 18 Ref.

Descriptors: *Pesticide residues, *Heavy metals, *Fluorine, *Birds, Estuarine environment, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Dieldrin, Cadmium, Copper, Lead, Zinc, Mercury, *Arsenic, *Selenium, *Tissue analysis, *Bioaccumulation, *New Zealand.

Five species of birds collected from 7 estuarine areas of New Zealand were analysed for organochlorine residues, fluorine, and heavy metals. There were no significant differences in residue levels between the areas studied other than in that of dieldrin, which was detected only in birds from the Auckland and Christchurch estuaries. There were no significant regional differences in bone fluorine. Pukekos had lower levels of organochlorines than the other species. Species differences for fluorine and for some of the heavy metals were probably related to the type of diet. In general the survey indicated little pollution of the environment, even near the most highly industrialized areas of the country. (Deal-EIS)
W80-03691

THE INFLUENCE OF ADSORPTION ON THE RATES OF MICROBIAL DEGRADATION OF ARSENIC SPECIES IN SEDIMENTS,
Wisconsin Univ.-Madison. Water Chemistry Program.
T. R. Holm, M. A. Anderson, R. R. Stanforth, and D. G. Iverson.
Limnology and Oceanography, Vol 25, No 1, p 23-30, 1980. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Microbial degradation, *Arsenic compounds, *Mathematical models, Chemical reactions, Biochemistry, Bacteria, Sediments, Chemical properties, Absorption, Precipitation(Chemical), *Biotransformation, *Arsenic.

A model to describe the rates of microbially mediated transformations is presented along with a simple numerical method for kinetic computations in complex systems. The model is tested against the results of arsenic demethylation experiments assuming first-order kinetics and Langmuir adsorption. There is agreement between theory and experiment. (Deal-EIS)
W80-03692

CHEMOTHERAPEUTICAL STUDIES ON TRIMETHOPRIM AGAINST VIBRIOSIS OF POND-CULTURED AYU--II. TISSUE LEVELS AFTER ADMINISTRATION OF TRIMETHOPRIM-SULFADOXINE MIXTURE (IN JAPANESE),
National Research Inst. of Aquaculture (Japan).
H. Sako, R. Kusuda, and T. Tabata.
Fish Pathology, Vol 14, No 2, p 65-70, 1979. 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Chemical properties, *Bactericides, *Fish diseases, Aquiculture, Chemical analysis, Pesticide kinetics, Pesticide residues, Fish physiology, Animal metabolism, *Tissue analysis, *TMP, *Ayu, *Plecoglossus, Trimethoprim, Fish hatcheries.

The present study was designed to investigate the pharmaco-dynamic properties of trimethoprim (TMP) in ayu, Plecoglossus altivelis, after oral administration of TMP-sulfadoxine (SDX) mixture for the control of vibriosis. The results obtained are summarized as follows: (1) Following a single administration of 30 mg of TMP-SDX(1:5) mixture per kg body weight, the highest tissue levels of TMP were obtained 2 hours after medication in the liver at the level of 10.8 mcg/g, 6 hours in the kidney at the level of 4.4 mcg/g, 2/3 hours in the muscle at the level of 1.8 mcg/g, and 1 hour in the blood at the level of 0.4 mcg/ml. (2) Following daily administration of 30 mg of TMP-SDX (1:5) mixture per kg body weight per day for 10 days, TMP level became undetectably low 24 hours after the last medication in the liver, 48 hours in the kidney and the muscle, and 6 hours in the spleen and the blood. (3) It is concluded that TMP is retained in the tissue for some hours, and is excreted almost completely from the fish within a day. Therefore, it is necessary to administer TMP-SDX mixture to ayu more than once a day to maintain constant tissue levels of TMP. (Deal-EIS)
W80-03693

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
For primary bibliographic entry see Field 5A.
W80-03696

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 5A.
W80-03703

SEMICONTINUOUS OUTDOOR CULTIVATION OF SCENEDESMUS ACUTUS IN WASTE WATER,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-03705

METHODS OF ESTIMATING SOME POSSIBLE INTERACTIONS OF AGRICULTURAL DEVELOPMENT AND WATER RESOURCES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 2A.
W80-03711

GEOLOGY AND GEOCHEMISTRY OF ARSENIC, ESTER DOME AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 2K.
W80-03712

STAGED MULTIPORT DIFFUSERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
C. W. Almquist, and K. D. Stolzenbach.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15185, p 285-302, February 1980. 10 Fig, 3 Tab, 20 Ref, 2 Append.

Descriptors: *Diffusion, *Waste dilution, *Effluents, Thermal pollution, Pollutants, Entrainment, Jets, Mixing, Model studies, Laboratory tests, Mathematical models, Hydraulics, Coastal engineering, *Diffusers, Staged multiport diffusers.

A staged multiport diffuser was schematized as an equivalent line source of momentum, neglecting the effects of effluent volume and buoyancy fluxes. Centerline effluent concentrations inferred from the predicted volumetric dilution induced by the diffuser discharge were in good agreement with values observed in laboratory scale models of staged diffusers. The theory was found to be applicable to the design of staged diffusers in coastal receiving waters. (Sims-ISWS)
W80-03717

INFLUENCE OF A COMPACT ZONE ON SOLUTE TRANSPORT DURING INFILTRATION OF WATER,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2G.
W80-03727

WATER-QUALITY ASSESSMENT OF THE L'ANGUILLE RIVER BASIN, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
C. T. Bryant, E. E. Morris, and J. E. Terry.
Available from: OFSS BX 25425, Fed. Ctr. Denver, CO paper copy $21.75 microfiche $3.50. Geological Survey open-file report 79-1482, 1979. 20 p, 22 Fig, 23 Tab, 45 Ref.

Descriptors: *Water quality, *Streams, *Arkansas, *Streamflow, *Channel morphology, Model studies, Surface-groundwater relationships, Effluents, Water analysis, Chemical properties, Physical properties, Biological communities, Water temperature, Sediment discharge, Nutrients, Pesticides, Dissolved oxygen, Data collections.

For several years, dissolved oxygen in the L'Anguille River has been reduced to concentrations of less than 5.0 milligrams per liter during the summer and fall. In addition, concentrations of pesticides have been reported consistently at one long-term station on the river, and trace metals have been reported at two long-term monitoring sites. The U.S. Geological Survey conducted an intensive study of the L'Anguille River basin during the summer and fall of 1978 in cooperation with the Arkansas Department of Pollution Control and Ecology. An assessment of the general water quality was made; the causes of stream dissolved-oxygen reductions were determined; and the occurrence of pesticides and trace metals in the basin was documented. A steady-state, segmented, dissolved-oxygen model was calibrated and used to project simulated dissolved-oxygen profiles. (Kosco-USGS)
W80-03758

PLACES IN CONNECTICUT WHERE GROUND WATER IS KNOWN TO HAVE DETERIORATED IN QUALITY,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03762

THE INFLUENCE OF URBANIZATION OF THE TRANSPORT OF HEAVY METALS IN NEW JERSEY STREAMS,
Rutgers - The State Univ., New Burnswick, N.J. Dept. of Environmental Science.
W. G. Wilber, and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153570, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Rutgers University, February 1980. Final technical completion report. OWRT A-050-NJ(5), 14-34-0001-8032.

Descriptors: *Heavy metals, *Water pollution sources, Chemical wastes, Sediment distribution, Sediment yield, Precipitation, Lead, Copper, Zinc, Urbanization, Urban runoff, Storm runoff, Water quality, *Saddle River basin(NJ), *Lodi(NJ), Street sweeping.

A study of the transport of heavy metals was performed on a highly developed 4.6-mile stretch of the Saddle River near Lodi, New Jersey. Heavy metal concentrations in stormwater runoff entering the study area varied significantly throughout runoff events and from storm to storm. Lead, zinc and copper contributed from 90 to 98 percent of the total metals measured. Distribution of metals in precipitation samples collected in the study was similar to that in runoff samples, with lead and zinc predominating, although concentrations of metals in rainfall were much lower than those in runoff. Base flow metal concentrations in tributaties to the Saddle River were variable, with highest levels occurring during wet weather. Metal concentrations in Saddle River sediments also varied; the importance of considering bottom scouring of relatively unconsolidated sediments in the transport of metals in river systems was noted.
W80-03774

PHOSPHRUS EXPORT FROM RURAL MAINE WATERSHEDS,
Maine Univ. at Farmington. Center fro Environmental Research and Education.
D. C. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153208, Price codes: A03 in paper copy, A01 in microfiche. Land and Resources Center, University of Maine, Orono. Completion Report, December 1979. 46 p, 13 Tab, 6 Fig, 19 Ref, 1 Append.

Descriptors: *Phosphorus, *Maine, *Eutrophication, *Watersheds(Basins), Land use, Nutrients, Lake stages, Surface waters, Aquatic algae, Mathematical models, Hydrology, Seepage, Sediments, Runoff, Non-point sources.

Methods to quantify non-point source contributions of phosphorus from selected watersheds in Maine are examined. Direct measurement approaches to measure stream phosphorus delivery include factors for phosphorus concentrations and discharge both of which vary with time. Direct approaches described are simulatneous measurement, vojume interval measurement, and typical concentration, all of which are weak because they do not provide for the effects of unusual or changing hydrologic conditions. Also these methods do not consider atmospheric fallout and underground seepage. Indirect estimate methods described are land use, soil erosion, and loading by non-stream sources. All of the methods discussed are summarized in a table giving the situations to which they apply, the information they provide, and limitations. In selecting a method for a particular case a user must consider land use, phosphorus forms, source identification, resources, and accuracy. The methods described were tested over a two year period on four drainage basins and their streams in Maine. Conclusions include: (1) stream total phosphorus (TP) is not directly related to discharge but does depend on flow conditions; (2) wading livestock, logging, or construction can cause higher TP concentrations; (3) eroding soil was not a major source of phosphorus; (4) in a normal year an undisturbed basin exported about 0.19kg TP/ha; and (5) TP export control should be aimed at avoiding disturbances in the watershed. Two methods for estimating non-point source phosphorus loads are recommended. (Seigler-IPA)
W80-03776

FLOW IN THE SEA OF HEAVY METALS FROM A SMELTER INDUSTRY,
T. Hellstrom.
Publication No B 518, Swedish Water and Air Pollution Research Institute, Stockholm, October, 1979. 133 p, 51 Fig, 34 Tab.

Descriptors: *Skellefte Bay, Sweden, *Mineral industry, *Heavy metals, *Distribution, *Mathematical models, *Waste water(Pollution), Gulf of Bothnia, Metals, Copper, Lead, Cadmium, Sedimentation, Discharge(Water), Water pollution, Wastes, Ronnskar, Sweden, Leaching, Sediments, Settling velocity, Flocculation, Currents(Water), Sea water.

A mathematical model indicates that one-third of the heavy metals discharged into Skellefte Bay, Sweden, from the Ronnskarsverken smelter industry are leaving the Bay; however, less than 10% of the metals are leaving the total modeled area and flowing into the Gulf of Bothnia. Ronnskarsverken smelter industry in northern Sweden produces copper, lead, zinc, cadmium, gold, silver, selenium and sulfuric acid. This report deals with lead, copper and cadmium in ionic form and total concentrations and their transport from Skellefte Bay to 100 m depth into the Gulf of Bothnia. Atmospheric emissions for lead, copper, and cadmium are 20, 19 and 0.7 tons/mo, respectively, and sea waste water discharges are 1.0, 1.5 and 0.25 ton/mo, respectively. From the Skellefte River, lead, copper and cadmium discharges are 1.5, 2 and 0.04 ton/mo, respectively, originating from mining activities in the catchment area. A metal flow model was developed to predict metal concentrations and sedimentation rates. The model divides the area into 62 surface and bottom boxes. Each box is completely mixed and works as a combined flocculation and sedimentation tank. Processes modeled include current patterns, flocculation, settling and sediment leaching. Half of Skellefte Bay contains metal concentrations considerably higher than background levels. Even though sediment metal concentrations are high, sediment leaching rates are almost negligible in order to explain the free water concentrations. (Danovich-Wisconsin)
W80-03788

CHARACTERISTICS OF EFFLUENTS FROM GRAY AND BLACK WATER SEPTIC TANKS,
Ontario Ministry of the Environment, Ottawa.
M. Brandes.
Journal Water Pollution Control Federation, Vol 50, No 11, p 2547-2559, November 1978. 3 Fig, 6 Tab, 30 Ref.

Descriptors: *Effluents, *Ontario, Canada, *Septic tanks, *Domestic wastes, *Separated sewers, Sludge, Sewage, Phosphorus, Nitrogen, Coliforms, Water quality, Water pollution, Sewage disposal, Waste disposal, Sewage bacteria, Chemical analysis, Detergents, Decomposing organic matter, Excrement.

This project studies chemical and bacteriological effluent characteristics from an Ontario household septic tank where gray water is treated, compared

to effluent from another septic tank at the same house used only for black (toilet) wastewater treatment. Gray water includes discharge from the kitchen sink, tub and shower, bathroom lavatory, dishwasher, and clothes washing machine. Using separate systems extends detention time in the toilet septic tank. Where normal phosphorus containing detergents are used, total and soluble phosphorus in gray water tank effluent is 7.8 and 0.24 mg/l respectively, compared with 1.4 and 0.17 mg/l, respectively, for phosphorus-free detergents. Average total and soluble phosphorus concentrations in black water septic tank effluent is 18.6 and 15.2 mg/l, respectively. Average total Kjeldahl nitrogen concentration in gray septic tank effluent is 11.3 mg/l, 14 times lower than in black (toilet) effluent. Average concentrations of total and suspended solids, BOD, TOC, and COD in black and gray water effluents are the same order of magnitude. Average concentrations of total and fecal coliform organisms in gray water effluent is 240,000/ml and 14,000/ml, respectively. Kitchen wastewater contains large amounts of organic matter that have undergone little breakdown. Required time intervals between gray water septic tank cleanings are 8-10 times longer than cleaning time intervals recommended for normal household septic tanks. (Danovich-Wisconsin)
W80-03791

MICROBIAL IMPACT OF CANADA GEESE (BRANTA CANADENSIS) AND WHISTLING SWANS (CYGNUS COLUMBIANUS COLUMBIANUS) ON AQUATIC ECOSYSTEMS,
Maryland Univ., College Park. Dept. of Microbiology.
D. Hussong, J. M. Damare, R. J. Limpert, W. J. L. Sladen, and R. M. Weiner.
Applied and Environmental Microbiology, Vol 37, No 1, p 14-20, January, 1979. 1 Fig, 2 Tab, 24 Ref. EPA R804206 and R804207.

Descriptors: *Chesapeake Bay, *Canada goose, *Coliforms, *Whistling swan, *Excrement, Microorganisms, Bacteria, Geese(Wild), Migratory birds, Waterfowl, Water birds, Water pollution, Water pollution sources, Enteric bacteria, Pathogenic bacteria, Migration, Migratory patterns, Ecosystems, Environmental effects.

Healthy whistling swans and Canadian geese, migrating along the eastern U.S. Flyway in Chesapeake Bay, do not harbor detectable enteric, bacterial pathogens. Freshly collected fecal matter from caged birds and from autopsied wild swans and geese do not yield Salmonella sp. Furthermore, Salmonella sp was not recovered from the four aquatic roosting sites included in the study. A random selection of 75 E. coli isolates from various waterfowl yields seven enterotoxin-producing E. coli. Waterfowl harboring these enterotoxigenic E. coli are all confined to Lake Shore Pond. Most of the anaerobic bacteria isolated are Escherichia and Streptococcus sp. Wild birds harbor significantly more fecal coliforms that fecal streptococci while the reverse is true for captive and fasting birds. In a 24-h period, a single swan eliminates one billion and a goose 10 million fecal coliforms (FC). At an artificial pond, Lake Shore, 25 captive swans and geese were maintained. Before the birds entered Lake Shore Pond, FC was 1/100 ml and after 220 bird hours, the count rose to 2,400/ml. Despite waste quality deterioration, neither Salmonella nor Shigella were isolated from the water or sediment. At Canninghouse Cove, the largest natural waterfowl roosting site, sediment FC counts rose from 13 to 170 FC/100 ml during the bird season. This sufficiently high population index could result in shell-fishing restrictions. (Danovich-Wisconsin)
W80-03794

PREDICTION OF THE QUALITY OF WATER IN A PROPOSED IMPOUNDMENT IN SOUTHWESTERN WISCONSIN, USA,
Wisconsin Univ.-Madison. Dept. of Soil Science.
D. R. Keeney.
Environmental Geology, Vol 2, No 6, p 341-349, 1978. 4 Fig, 9 Tab, 17 Ref.

Descriptors: *Kickapoo River(WI), *Phosphorus, *Impoundments, *Impounded waters, *Nutrient loading, Nutrients, Nonpoint pollution, Eutrophication, Water quality, Nitrogen, Recreation, Lake La Farge(WI), Base flow, Forecasting, Agricultural runoff, Runoff, Flood control, Decision making, Multiple-purpose reservoirs, Vollenweider models.

Due to large estimates of nutrient loadings and resultant eutrophic water quality is proposed Lake La Farge impoundment on the Kickapoo River, Wisconsin, federal funding was withdrawn from the project. Phosphorus loadings to the impoundment are estimated to be 4.4 g/sq/ m/yr. To reach Vollenweider's permissible levels, P loadings must be 0.2 g/sq m/yr; this cannot be achieved since base flow contributes nearly one-third of total P loading. Runoff supplies a major portion of Nitrogen (39%) and P (30%) to the impoundment. Base flow is also an important nutrient source, providing 35% of N and 32% of P. Recognizable point sources (sewage treatment plants and farmyards) supply 26% and 37% of N and P, respectively. Tertiary sewage treatment for the small communities is difficult to justify economically. Area farms currently practice well-above-average conservation practices, and little improvement in nonpoint nutrient removal would occur without considerable expense. However, in-lake treatment to remove weeds and algae from high-use areas could be done at minimal costs. The large multipurpose impoundment providing flood control and reacreation was first proposed in the 1960s. Construction commenced in 1971-1972 while about 1970-1971 several environmental groups petitioned against completing the impoundment. Major contention involved recreational benefits which assumed water quality good enough for recreational use of the impoundment. (Danovich-Wisconsin)
W80-03801

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03818

MECHANICAL HYDRILLA CONTROL IN ORANGE LAKE, FLORIDA,
Army Engineer District, Jacksonville, FL.
For primary bibliographic entry see Field 4A.
W80-03833

ADSORPTION-DESORPTION OF DIURON BY FRESHWATER SEDIMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. E. Peck, D. L. Corwin, and W. J. Farmer.
Journal of Environmental Quality, Vol 9, No 1, p 101-106, January-March 1980. 3 Fig, 7 Tab, 18 Ref. (California Water Resources Center Project UCAL-WRC-W-485).

Descriptors: *Adsorption, *Herbicides, *Pesticides, Sediments, Water quality, California, Diuron, Organic carbon, Temperature.

Freshwater sediments were collected from eight different locations in California to study the influence of sediment properties on the adsorption and desorption of the model herbicide, diuron (3-(3,4 dichlorophenyl)-1,1 dimethylurea). The sediments were characterized as to physical and chemical properties using the same methods used for soils. The sediments had a range of organic carbon of 0.91 to 19% and were high in silt and clay. The adsorption of diuron was described by the Freundlich equation. Adsorption at 25C expressed as the Freundlich coefficient, k, was positively correlated to the amount of organic carbon present. There was no correlation with total CEC. The desorption of diuron was evaluated by taking the difference between the slopes of the adsorption and desorption isotherms. As the difference between these slopes increased, less diuron was desorbed. These differences were positively correlated to k and organic carbon. Adsorption at temperatures of 5, 25, and 40C on three sediments indicated that the adsorption of diuron decreased as the temperature increased. (Snyder-California)
W80-03838

ORGANOCHLORINE INSECTICIDES AND PCBS IN SEDIMENTS OF LAKE ST. CLAIR (1970 AND 1974) AND LAKE ERIE (1971),
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
For primary bibliographic entry see Field 5C.
W80-03894

5C. Effects Of Pollution

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
For primary bibliographic entry see Field 5B.
W80-03609

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W80-03611

THE EFFECTS OF BOTTLE VOLUME, THALLUS WEIGHT, OXYGEN SATURATION LEVELS, AND WATER MOVEMENT ON APPARENT PHOTOSYNTHETIC RATES IN MARINE ALGAE,
California Univ., Irvine.
M. M. Littler.
Aquatic Botany, Vol 7, p 21-34, 1979. 5 Fig, 2 Tab, 30 Ref. (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(9).

Descriptors: *Marine algae, *Photosynthesis, *Weight, *Volume, *Movement, Photosynthetic oxygen, Aquatic life, Aquatic plants, Photosynthetic rates.

The importance of container volume, thallus weight, O2 tension, and water motion to measurements of photosynthetic rates in Ulva lobata (Kutz.) Setchel and Gardner (a species with a relatively high photosynthetic rate) and Colpomenia sinuosa (Roth) Derb. and Sol. (relatively low photosynthetic rate) were examined by means of O2 changes in bottles and through pH and O2 flux in continuously monitored chambers. The photosynthetic rate of Ulva averaged 36% lower in 310-ml bottles than in 1220-ml jars. Apparent photosynthesis varied as a function of (1) the initial dissolved O2 levels (regardless of bottle size), and (2) the particular metabolic reactions of the individual producers to different O2 tensions. Although similar trends were observed for Colpomenia, the effects of bottle size and initial O2 concentration were not as pronounced as for Ulva. The larger thallus weights of both species resulted in lower photosynthetic values, even in the large containers, due to clumping and self-shading of individual thalli. Mixing had a greater effect on apparent photosynthesis than on dark respiration, and was more critical for Ulva than for Colpomenia. Specific recommendations are put forth to deal with problems arising from the variations in methodology examined. (Snyder-California)
W80-03659

SEASONAL VARIATIONS IN NET PHOTOSYNTHETIC PERFORMANCE AND COVER OF INTERTIDAL MACROPHYTES,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, S. N. Murray, and K. E. Arnold.
Aquatic Botany, Vol 7, p 35-46, 1979. 1 Fig, 2 Tab, 32 Ref. (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(10).

Descriptors: *Macrophytes, *Photosynthesis, *Seasonal, *Fluctuations, *Intertidal areas, Benthos, Aquatic algae, Benthic flora, *Marine algae, Marine plants, Aquatic productivity, *San Clemente Island(Calif).

Standing stocks and net photosynthetic performances were determined concurrently for the 13 most abundant intertidal macrophytes from San Clemente Island, California over a four-season period. Highest net production rates were measured during summer for nine of the 13 species and minimum rates were recorded in spring and to a lesser extent during winter. Correlations between seasonal fluctuations in standing stock and productivity were evident for only eight species. Total daily community production reached a peak in the fall and declined sharply through winter to a spring low, closely paralleling changes in ambient water temperature. Blue-green algae, C. officinalis var. chilensis, P. capillacea, and E. menziesii contributed 76% of the total community primary productivity for the year. Seasonal patterns of photosynthetic performances were highly variable with a tendency for most species to attain peak daily photosynthetic rates coincident with higher temperatures and longer daylength. (Snyder-California)
W80-03660

THE REACTION OF PHRAGMITES COMMUNIS ROOTS TO DDT AND HEXACHLORANE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. I. Merezhko, T. I. Shokod'ko, N. N. Smirnova, and M. B. Dontsov.
Hydrobiological Journal, Vol 14, No 4, p 100, 1978.

Descriptors: *Root systems, *Absorption, *Pesticide toxicity, DDT, Plant physiology, Plant growth, Mode of action, Root development, Rooted aquatic plants, Chlorinated hydrocarbon pesticides, Marsh plants, *Hexachlorane.

The absorption capacity of the root system of the reed Phragmites communis was studied using concentrations of DDT and hexachlorane ranging from 25 to 2000 microg/l. Low concentrations of pesticides (25 and 50 microg/l) inhibit the growth of adventitions roots in soil and water and reduce the total and active absorbing surface. In addition the cation exchange capacity and the anion exchange capacity of the roots are increased. A further increase in the concentrations of pesticides increased the total and active absorbing surface of the roots in water but decreased the same values in soil. The different reaction of the root systems to a change in pesticide concentration is hypothesized as a protective function ensuring a definite level of activity. (Deal-EIS)
W80-03661

EFFECT OF SOME CHEMICAL AGENTS ON THE UPTAKE OF 32P AND 65ZN BY MACROPHYTES IN THE BLACK SEA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5B.
W80-03662

THE ABSORPTION OF DDT BY VASCULAR AQUATIC PLANTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5B.
W80-03663

THE DISTRIBUTION AND ECOLOGY OF THE NAIDIDAE (OLIGOCHAETA) WHICH INHABIT THE FILTER-BEDS OF SEWAGE-WORKS IN BRITAIN,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
M. A. Learner.
Water Research, Vol 13, p 1291-1299, 1979. 2 Fig, 7 Tab, 20 Ref.

Descriptors: *Worms, *Dominant organisms, *Sewerage, Animal populations, Sewage treatment, Industrial wastes, Filtration, Oligochaetes, Water chemistry, Biochemical oxygen demand, Organic loading.

A survey of sewage filter-beds situated throughout Great Britain showed that naidid worms were frequently an important component of the faunal community. The three commonest species were Nais variabilis, N. elinguis, and Pristina idrensis. Their occurrence and abundance were determined principally by the organic loading received by the beds, the amount of film present, and the presence of industrial waste. All the species found are considered beneficial to the functioning of the filter-bed. (Deal-EIS)
W80-03666

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS TRANSFERRED TO FISH FROM PETROLEUM SUSPENSION BY MASS CHROMATOGRAPHY,
Okayama Univ. (Japan). Dept. of Public Hygiene.
For primary bibliographic entry see Field 5B.
W80-03671

MACROINFAUNAL STRUCTURE AND EFFECTS OF THERMAL DISCHARGES IN A MESOHALINE HABITAT OF CHESAPEAKE BAY, NEAR A NUCLEAR POWER PLANT,
Academy of Natural Sciences of Philadelphia, PA.
T-N. Loi, and B. J. Wilson.
Marine Biology, Vol 55, p 3-16, 1979. 11 Fig, 2 Tab, 61 Ref.

Descriptors: *Biological communities, *Toxicity, *Nuclear powerplants, *Chesapeake Bay, Maryland, Water temperature, Heated water, Thermal stress, Sampling, Benthic fauna, Dominant organisms, Bottom sediments, Seasonal, Mollusks, Clams, Habitats, Mathematical models, Calvert Cliffs Nuclear Power Plant, *Species diversity, *Species diversity indices, *Polychaetes, *Shannon-Wiener index.

The soft-bottom macroinfauna of the Chesapeake Bay near the Calvert Cliffs Nuclear Power Plant, Maryland, USA, was studied quarterly in 1977. A total of 42,900 organisms distributed among 55 taxa was taken in 180 Smith-McIntyre grabs. Two communities and an ecotone between these two communities were identified in association with three sediment types: sand, sand-clay, and clay. Reproductive activities of 8 numerically dominant species are described. The macroinfauna at Calvert Cliffs was largely seasonal; species richness and organism abundances were lowest in late summer. The polychaetes Scolecolepides viridis and Heteromastus filiformis and the bivalves Macoma balthica and Mya arenaria were dominant in March-June. In September-December, the polychaetes Neanthes succinea, Paraprionospio pinnata, and Glycinde solitaria and the bivalve Gemma gemma became dominant. There were clear indications of differences associated with sediment types in total number of species, total number of individuals, and abundances of the dominant species. The shallower and intermediate habitats had higher sand-clay ratios, lower organic carbon contents, and larger numbers of organisms than the deeper clay habitat. Within each depth, no apparent detrimental effects caused by the thermal discharges on total number of species, total number of individuals, abundances of the dominant species, species diversity or evenness were found. (Deal-EIS)
W80-03672

COMPARISON OF VARIOUS METHODS FOR ESTIMATING THE QUALITY OF WATER BASED ON BOTTOM-DWELLING INDICATOR INVERTEBRATES,
Ukranian Hydrobiology Inst. Kherson (USSR). Kherson Hydrobiological Station.
For primary bibliographic entry see Field 5A.
W80-03673

VARIATION IN THE REACTIONS OF DAPHNIA MAGNA STRAUS TO THE EFFECT OF A TOXICANT AS RELATED TO ITS DELIVERY REGIME,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-03676

ZOOPLANKTERS AS BIOINDICATORS OF WATER QUALITY,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
M. F. Polivannaya, and O. A. Sergeyeva.
Hydrobiological Journal, Vol 14, No 3, p 39-43, 1978. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Bioindicators, *Zooplankton, *Water quality, Biological communities, Dominant organisms, Toxicity, Mathematical models, Trophic level, Mesotrophy, Oligotrophy, Biomass, Daphnia, Aquatic insects, Nematodes, Crustaceans, Water pollution effects, Aquatic populations, *Species diversity, *Species diversity indices.

The purpose of this study was to conduct a comparative evaluation of methods of biological analysis of water quality by using, as an example, zooplankton of the Dnieper River and the Kanev reservoir (USSR). Our material consisted of samples collected in the river in 1969 and 1972, and in the reservoir in 1975. The results indicate that pollution leads to less varied species composition of the zooplankton. The first to suffer are crustaceans and, among them, the nonpredator forms. Polyphagous insects (Asplanchnidae, Brachionus calyciflorus, Brachionus angularis and predator Cyclopoidae) tend to maintain themselves in the plankton. The data indicate an abrupt dip of the number of zooplankton dominants in river zones subjected to pollution and that the percentage of a few species under these circumstances. Age composition, replenishment and loss, fertility, morphometric characters of populations of leading species under normal conditions and during disturbances associated with pollution may serve as supplementary indices of water quality that are calculated in terms of zooplankton. (Deal-EIS)
W80-03678

DEPENDENCE OF THE TIME OF GAMETE MATURATION AND SPAWNING ON ENVIRONMENTAL TEMPERATURE IN THE VIRGINIA OYSTER CRASSOSTREA VIRGINICA,
Akademiya Nauk SSSR, Petrozavodsk. Dept. of Water Problems.
Z. F. Kaufman.
Hydrobiological Journal, Vol 14, No 4, p 29-30, 1978. 1 Fig, 5 Ref.

Descriptors: *Water temperature, *Toxicity, *Growth rates, *Oysters, Animal growth, Spawning, Reproduction, Mathematical models, Thermal stress, Animal physiology.

An equation is given in which the rate of gametogenesis, and the time of the first spawning and of mass spawning are a function of environmental temperature. All three processes were governed by van't Hoff's rule in the 20-30C range, i.e., an increase in temperature by 10C increased their rate by 2-3 times. This pattern was significantly altered in the range 15-20C. The rate of appearance of the first eggs was speeded up 4-fold, the time to the first spawning was reduced 1/5, and the time to mass spawning to 1/8. (Deal-EIS)
W80-03679

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-03680

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN, II ROLE OF WATERCHESTNUT IN PRIMARY PRODUCTIVITY AND NUTRIENT UPTAKE,
Tsukuba Univ., Sakuramura Ibaraki (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W80-03681

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
For primary bibliographic entry see Field 5A.
W80-03683

INVESTIGATIONS ON THE EFFECTS OF DOMESTIC SEWAGE ON THE BENTHIC ECOSYSTEM OF MARINE INTERTIDAL FLATS (IN GERMAN),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischerei-wissenschaft.
G. Otte.
Helgolander wissenschaftlichen Meeresuntersuchungen, Vol 32, p 73-148, 1979. 183 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Aquatic life, Benthic flora, Benthic fauna, Intertidal areas, Outfall sewers, Domestic wastes, Sewage disposal, Waste water disposal, Water chemistry, Primary productivity, Bacteria, Dominant organisms, Bioindicators, Sylt, Germany, Vancouver, British Columbia, *Species diversity.

Primary productivity of microalgae on the sediment surface was positively correlated with the degree of pollution. In heavily and mediumly polluted zones, heterotrophic bacterial production exceeded primary production rates at the sediment surface. Compared with unpolluted intertidal flats the number of macro-benthic species was not reduced in polluted mud flats. In regard to overall species abundance, the macrofauna associations of the disposal area showed three distinct zones: (1) Heavy pollution around the outfall resulted in a degradation zone either without benthic invertebrates or with a very low density of individuals; (2) medium polluted areas were characterized by a zone of maximum density; (3) with decreasing or diminishing pollution the number of individuals returned to normal values ('background values'). The distribution of species within these zones indicated a significant difference between the response of the 'channel fauna' and the 'flat fauna' to pollution: while the number of species increased continously inside the channels with decreasing pollution, the species variety of the tidal flats was positively correlated with the number of individuals. The diversity of the benthos inside the channels was negatively correlated with the degree of pollution, whereas the diversity indices for the fauna on the tidal flats increased quickly from the centre of pollution, remained at a high level in the medium polluted zone, and decreased again to the area of diminishing pollution. (Deal-EIS)
W80-03684

IN VITRO INHIBITION OF THREE PHOSPHATASES BY MERCURIC CHLORIDE AND THEIR REVERSAL BY CHELATING AGENT EDTA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03685

TRANSFER OF 14C-TOLUENE FROM MOSQUITO LARVAE TO BLUEGILL SUNFISH,
Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
For primary bibliographic entry see Field 5B.
W80-03686

MOBILIZATION OF ORGANOCHLORINES FROM FEMALE LIPID TISSUE AND TRANSPLACENTAL TRANSFER TO FETUS IN A HARBOUR PORPOISE (PHOCOENA PHOCOENA) IN A CONTAMINATED AREA,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W80-03687

EFFECTS OF ARTIFICIAL ACID RAIN ON MICROBIAL ACTIVITY AND BIOMASS,
Lund Univ. (Sweden). Dept. of Microbial Ecology.
E. Baath, B. Lundgren, and B. Soderstrom.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 737-740, 1979. 1 Tab, 9 Ref.

Descriptors: *Acidic water, *Acidic soils, *Rain, Acidity, Hydrogen ion concentration, Rainfall, Artificial precipitation, Water chemistry, Bacteria, Fungi, Respiration, Physiology, Growth rates, Biomass, Soils, *Acid rain.

Respiration, FDA-active fungal length and FDA-active bacteria are all parameters related to microbial activity in the soil. These parameters all decreased in the acidified plots (Tab. 1). Total fungal length and bacterial numbers did not change significantly in response to artificial acid rain, indicating that the microbial immobilization of mineral elements was little affected in this experiment. Bacterial cell size was smaller in the most acidified plots. Mean cell size in this treatment was 0.10, m3, compared to 0.13, m3 in the control and the pH 3 treated plot. The reduced cell size could be due to changes in the bacterial population, or it could reflect a lower bacterial growth rate after treatment with pH 2 water. It seems most likely that the decreased microbial activity, directly or indirectly, is a hydrogen ion effect. However, since pH was adjusted with sulphuric acid, it cannot be excluded that the added sulphate influenced the microorganisms negatively. (Deal-EIS)
W80-03688

COPPER TOXICITY TO THE BAY SCALLOP (ARGOPECTEN IRRADIANS),
Environmental Research Lab., Narragansett, RI.
G. Pesch, N. Stewart, and C. Pesch.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 759-765, 1979. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Copper, *Toxicity, *Mollusks, Growth rates, Mortality, Animal behavior, Juvenile growth stage, Animal physiology, Animal metabolism, Lethal limit, Bioindicators, Inhibition, *Bioaccumulation, *Tissue analysis, *Scallops, *Argopecten.

The purpose of this study was to examine the effect of copper on survival, growth, and byssal attachment, and copper accumulation of juvenile bay scallops in a flowing water exposure system. At each of the 4 highest concentrations (110, 48, 21, and 11 microg/l) more than half of the scallops died during the 42-day experiment. At the lowest concentration, 5 microg/l, 10% of the scallops had died by day 42. An incipient LC50 value of 9.3 microg/l Cu was estimated graphically from the toxicity curve. Growth was inhibited at all concentrations. At the 4 highest concentrations (110, 48, 21, and 11 microg/l), we observed that before death the scallops detach from their substrates and lie free on the bottom of the aquaria. The response of the scallops to copper indicates an initial acute effect as shown by the detachment. However, some of the survivors adjusted to the presence of copper and reattached. The relationship between detachment and death was linear. Accumulation of copper by bay scallops in this study is comparable to data from other studies that show molluscs accumulate copper readily and elevated copper concentrations in the environment are reflected by elevated copper concentrations in molluscs. (Deal-EIS)
W80-03689

THE EFFECTS OF THE ANAESTHETIC QUINALDINE ON OXYGEN CONSUMPTION IN AN INTERTIDAL TELEOST BLENNIUS PHOLIS (L.),
Plymouth Polytechnic (England) School of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W80-03690

ORGANOCHLORINE, FLUORINE, AND HEAVY-METAL LEVELS IN SOME BIRDS FROM NEW ZEALAND ESTUARIES,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
For primary bibliographic entry see Field 5B.
W80-03691

EVALUATION OF SAPROBICITY OF THE VOLGOGRAD RESERVOIR IN TERMS OF THE PHYTOPLANKTON,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
A. G. Okhapkin, and G. V. Kuz'min.
Hydrobiological Journal, Vol 14, No 3, p 35-39, 1978. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Productivity, *Phytoplankton, *Reservoirs, Seasonal, Aquatic populations, Sewage effluents, Trophic level, Dominant organisms, Diatoms, Aquatic algae, Cyanophyta, Mesotrophy, Oligotrophy, Monitoring.

The saprobicity of the Volgograd reservoir and ratio of indicator species changed during the vegetative period. The peak saprobicity indexes in summer dropped due to intensification of self-purification processes. In autumn they were almost the same as in summer. The saprobicity of the water downstream of cities increased due to effluents. A comparison with the data available in literature showed a gradual rise in saprobicity of the Volga from 1902 to the present. (Deal-EIS)
W80-03694

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
For primary bibliographic entry see Field 5A.
W80-03696

EYE DAMAGE TO THE GRASS CARP (CTENOPHARYNGODON IDELLA) FROM CHRONIC UPTAKE OF STRONTIUM 90,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Inst. Zoologii.
V. I. Nilov, V. M. Fedoseyenko, and I. A. Shekhanova.
Journal of Ichthyology, Vol 16, p 1001-1006, 1976. 5 Fig, 14 Ref.

Descriptors: *Carp, *Fish diseases, *Strontium radioisotopes, Absorption, Path of pollutants, Radiochemical analysis, Animal pathology, Radioisotopes, Growth stages, Fish physiology, Animal metabolism, *Tissue analysis.

An investigation was made of the distribution of strontium 90 in the eye tissues of the grass carp (Ctenopharyngodon idella) from the chronic uptake of this radionuclide. It was found that the nature of the distribution of strontium 90 in the eye tissues was not identical. The largest amount of the isotope is found in the lens, the least amount in the retina. Localization of strontium 90 is observed in the photoreceptor cells on the outer membrane of the segments of the cones and rods and on their disk membranes. The chronic uptake of the radionuclide by grass carp fingerlings over a period of 2 months led to pathological changes in the eye tissues. (Deal-EIS)
W80-03697

FISH MORTALITY AND FISHING DURING AN UNPRECEDENTED DRAUGHT IN LAKE PICHHOLA, UDAIPUR,
Udaipur Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W80-03698

PESTICIDES AND AQUATIC ECOSYSTEMS,
Kalyani Univ., West Bengal, (India). Dept. of Zoology.
S. K. Konar.
India Journal of Fisheries, Vol 22, p 80-85, 1975. 3 Fig, 22 Ref.

Descriptors: *Pesticide toxicity, *Public health, *Ecosystems, Pesticide kinetics, Fishkills, Carp,

Catfishes, Cytological studies, Pesticide residues, Mortality, *Tissue analysis, *DDVP, *Parathion, *Phosphamidon, *Bioaccumulation, India, Punarbhava River.

A survey made in West Bengal to evaluate the influence of pesticides on aquatic ecosystems showed that pesticides killed many fishes in Punarbhava River, West Dinajpur, in August 1970. The paddy fields near the river recieved the insecticides: DDVP, phosphamidon and parathion. The tissues of gills, alimentary tract, liver and brain of the exposed carp (Labeo rohita) and catfish (Heteropneustes fossilis) were found severely damaged. The pesticide residue in fish was in levels that may cause hazard to fish eaters. (Deal-EIS)
W80-03699

ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND,
Connecticut Dept. of Environmental Protection, Middlebury.
For primary bibliographic entry see Field 5A.
W80-03702

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03703

THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE INTERACTIONS OF CHLORINE, ELEVATED TEMPERATURE, AND EXPOSURE DURATION FOR GRASS SHRIMP, PALAEMONETES PUGIO,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5A.
W80-03704

STUDIES ON THE EFFECTS OF ACIDIC MEDIUM ON THE FRY OF CYPRINUS CARPIO,
Holkar Science Coll., Indore (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03706

THE EFFECTS OF OYSTER SHELL DREDGING ON AN ESTUARINE BENTHIC COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W80-03734

TAXONOMIC NOTES ON EPIPHYTIC DIATOMS OF MISSISSIPPI SOUND, U.S.A.,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
M. J. Sullivan.
Nova Hedwigia, Vol 64, p 241-249, 1979. 1 Fig, 7 Ref, 4 Pl. OWRT A-114-MISS (3), 14-34-0001-8026.

Descriptors: *Diatoms, *Systematics, *Electron microscopy, *Sessile algae, *Rooted aquatic plants, Ecological distribution, Biogeography, Marine algae, Submerged plants, Aquatic habitats, Mississippi, *Epiphytic algae, *Seagrasses, Horn Island(Miss. Sound), Halodule, Syringodium, Thalassia.

Epiphytic diatoms were collected from the leaves of three seagrass species (Halodule beaudettei, Syringodium filiforme, and Thalassia testudinum) in Mississippi Sound during the summer of 1977. A previous paper by the author showed that nearly identical diatom communities were found on each seagrass based on the distribution of the more abundant taxa and statistical comparisons. The present paper provides taxonomic information on selected diatom taxa using light and scanning electron microscopy. Of the eight taxa treated, five are araphid forms. Descriptions of the majority of these taxa based on light microscope observations are herein amplified by examination of cleaned material under the scanning electron microscope.
W80-03781

EFFECTS OF DINOFLAGELLATE BIOLUMINESCENCE ON THE INGESTION RATES OF HERBIVOROUS ZOOPLANKTON,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
H. S. White.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 3, p 217-224, February, 1979, 2 Fig, 22 Ref.

Descriptors: *Bioluminescence, *Dinoflagellates, *Grazing, *Predation, *Copepods, Zooplankton, Cytological studies, Regression analysis, Animal physiology, Florescence, Cultures, Digestion, Diets, Feeding rates, Food habits, Animal populations, Denisty, Swimming, Movement.

Acartia tonsa, a copepod, grazes more slowly on the Dingflagellate Gonyaulax excavata when the latter is highly luminescent, except at lowest experimental concentrations (<500 cells/ml). Natural zooplankton organism concentrations cannot exhaust bioluminescence of healthy Gonyaulax excavata cells. Highly luminescent culture depress grazing rates 50-75% relative to weakly and very weakly bioluminescent cultures. The regression line slope for highly luminescent cultures is significantly different from that of the other two ($P=0.99$). In-situ grazing rates on dinoflagellates fluctuate in response to changes in cell bioluminescent capacity. This is especially true at high cell densities, such as exist during a bloom. Culture experiments used one animal/3 ml (333 animals/1), however, normal natural concentrations are considerably lower. A. clausi stimulates 0.3-2.2% (average 1.1%) of the luminescent capacity per minute, while Pseudocalanus minutus stimulates only 0.0-0.1%, indicating interspecific differences. Therefore, bioluminescence may not equally deter all predator types. A. clausi copepods move in a series of short darts forward, while P. minutus moves in a smooth glide. The latter swimming apparently does not shear cells with a force above emission threshold. Results suggest dinoflagellate bioluminescence effectively reduces predator grazing and cell populations have sufficient emission capacity to respond to continual animal activity. (Danovich-Wisconsin)
W80-03782

CARNIVOROUS FEEDING BEHAVIOR OF THE ADULT CALANOID COPEPOD ACARTIA TONSA DANA,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. J. Lonsdale, D. R. Heinle, and C. Siegfried.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 3, p 235-248, February, 1979. 7 Fig, 2 Tab, 42 Ref. ERDA AT-(401-1)14848, NSF SMI76-03130.

Descriptors: *Copepods, *Predation, *Food habits, *Animal behavior, Size, Algae, Diets, Digestion, Speciation, Denisty, Growth stages, Foods, Food abundance, Carnivores, Omnivores, Cultures, Laboratory tests, Ecology, Regression analysis.

Significantly high predation rates of Acartia tonsa on its potential competitors may affect copepod seasonal variation and species composition. A. tonsa flexibility in exploiting food resources may be the major reason why this copepod dominates estuarine and coastal waters. Laboratory experiments observed carnivorous feeding behavior of A. tonsa, a calanoid copepod known to be omnivorous. A. tonsa adults feed on various copepod nauplii species including A. tonsa, Scottolana canadensis, Oithona colcarva, and Eurytemora affinis. Selection experiments show A. tonsa adults avoid A. tonsa nauplii as prey and prefer E. affinis and S. canadensis nauplii. Preconditioning A. tonsa adults with one of the three nauplii species does not alter this selection against A. tonsa nauplii. Naupliar size is also important; smaller sized prey are usually preferred. Ingestion rate of Pseudoisochrysis (algae) by adult A. tonsa (0-1.23 million cu micro m/adult h) with no nauplii available increases with algal concentration (0.16-1.51 ppm). Ingestion rate of algae (0-1.48 million cu micro m/adult h) with an alternate food source, either A. tonsa or S. canadensis nauplii, also increases with algal concentration (0.14-2.35 ppm). A. tonsa adult predation rates on A. tonsa nauplii increases with greater prey densities. This is observed with algae present or absent. (Danovich-Wisconsin)
W80-03783

THE EFFECTS OF VERTICAL STABILITY ON PHYTOPLANKTON DISTRIBUTIONS IN THE SUMMER ON THE NORTHWEST EUROPEAN SHELF,
Institute of Oceanographic Sciences, Wormley (England).
R. D. Pingree, P. M. Holligan, and G. T. Mardell.
Deep-Sea Research, Vol 25, No 11, p 1011-1028, November 1978. 11 Fig, 2 Tab, 28 Ref.

Descriptors: *Phytoplankton, *United Kingdom, *Continental shelf, *Water circulation, *Vertical distribution, Mixing, Distribution, Tides, Tidal effects, Water temperature, Chlorophyll, Depth, Nutrients, Winds, Thermal stratification, Mathematical models, Hydrologic aspects, Growth rates, Upwelling, Wind tides, Summer, Primary productivity, Diatoms, Dinoflagellates.

Phytoplankton distributions in frontal regions on the Northwest European Shelf, July 1977, are interpreted in terms of tidal energy dissipation rate per unit mass, E, and water depth scaled by the extinction coefficient. These two parameters largely determine the physical environment in which phytoplankton growth and the area between $-2.0<\dot{E}<-1.0$, which includes frontal boundaries and shallow thermoclines, defines the most productive region during summer months. Data were analyzed for separate geographical areas; western North Sea, northwestern North Sea, between Scotland and Ireland and Celtic Sea and western English Channel. In weakly-stratified and well-mixed waters diatoms are most abundant. Species composition varies from benthic types inshore to neritic and more oceanic communities; few dinoflagellates are found. In surface waters overlying well-developed thermoclines, chlorophyll-a levels are generally low and dinoflagellates are dominant. Phytoplankton populations in the thermocline are in three groups according to surface-to-bottom temperatures differences (TD): $TD<3$ C, dinoflagellates and diatoms; TD 3-6 C, dinoflagellates; and $TD>6$ C, flagellates. In frontal regions, mixed populations of dinoflagellates and diatoms form high chlorophyll concentrations. Species composition differences probably reflect variations in nutrients. Chlorophyll-a distributions relate to availability of light and inorganic nutrients for phytoplankton growth which, in turn, are determined by vertical stability, depth and turbidity of the water column. (Danovich-Wisconsin)
W80-03784

CHEMICAL FLUCTUATIONS DUE TO SEASONAL AND CROPPING EFFECTS ON AN ALGAL-SEAGRASS COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03785

THE NUTRITIONAL ECOLOGY OF CYPERUS ESCULENTUS, AN EMERGENT AQUATIC PLANT, GROWN ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experimental Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2I.
W80-03786

AEROMONAS DISTRIBUTION AND SURVIVAL IN A THERMALLY ALTERED LAKE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.

For primary bibliographic entry see Field 4A.
W80-03787

NITRATE AND PHYTOPLANKTON PRODUCTION IN SOUTHERN CALIFORNIA COASTAL WATERS,
Scripps Institution of Oceanography, La Jolla, CA.
R. W. Eppley, E. H. Renger, and W. G. Harrison.
Limnology and Oceanography, Vol 24, No 3, p 483-494, May, 1979. 7 Fig, 40 Ref. USDOE EY-76-C-03-0010, PA20.

Descriptors: *Nitrates, *Primary productivity, *Phytoplankton, *Coasts, *Southern California, *Euphotic zone, Standing stocks, Equations, Environmental gradient, Carbon, California, Photosynthesis, Diffusion, Correlation analysis, Testing, Upwelling, Nutrients, Nutrient transport, Depth, Diffusivity, Biochemistry, Marine biology.

Nitrate transport into the euphotic zone is the major factor regulating phytoplankton standing stock and production in southern California coastal waters. This was tested by examining the null hypothesis that phytoplankton production is independent of nitrate input rates to the euphotic zone. The null hypothesis is rejected due to the low surface nitrate concentration, 0.5 micro g-at/l, in southern California coastal waters, except during strong upwelling. Carbon and nitrate assimilation rates are related; rank difference correlation coefficient is 0.73, implying that 53% of the variation in either variable is explainable by its correlation with the other. Further evidence includes the following: (1) Phytoplankton standing stock and production rate relate to vertical nitrate concentration gradient depth. (2) Particulate organic matter chemical composition, expressed as POC:PON ratio, relates to phytoplankton C:N assimilation ratio. (3) Regenerated production, measured as ammonium assimilation, is proportional to nitrate assimilation rate, implying parallel and concurrent increases in heterotrophic microplankton and phytoplankton production due to new euphotic zone nitrate inputs. (4) Vertical nitrate diffusion, when calculated from vertical nitrate concentration gradients and nitrate assimilation rates, reasonably estimates vertical eddy diffusivity for nitrate. Eleven quarterly cruises in the Southern California Bight, February 1975-August 1977, provided data for this report. (Danovich-Wisconsin)
W80-03789

VERY SIMPLE MODEL OF THE INITIAL STAGE OF OLIGOTROPHIC-EUTROPHIC SUCCESSION. IN BODIES OF WATER,
Moscow State Univ., (USSR).
For primary bibliographic entry see Field 5A.
W80-03792

THE EFFECT OF PHOSPHATE AND TEMPERATURE ON GROWTH OF ACTIVATED SLUDGE AND ON BIODEGRADATION OF SURFACTANTS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5D.
W80-03793

THE DISTRIBUTION OF ALGAL EPIPHYTES ON MACROPHYTE HOSTS OFFSHORE FROM LA PARGUERA, PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
D. L. Ballantine.
Botanica Marina, Vol 22, No 2, p 107-110, February 1979. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Marine algae, *Epiphytology, *Distribution, *Hosts, *La Parguera, Puerto Rico, Marine plants, Caribbean Sea, Bryothamnion triquetrum, Laurencia poitei, Digenia simplex, Dasya pedicellata, Halymenia floresia, Crysemenia enteromorpha, Ceramium byssoideum, Polysiphonia havanensis, Calithamnion byssoides, Microcoleus lyngbyaceus, Plant pathology, Distribution patterns, Biological communities, Age, Macrophytes, Algae.

During August 1973 - May 1976, 122 species of epiphytes were identified from an algal plain located two miles off the southwest coast of Puerto Rico. Hosts vary in ability to support epiphytic communities. Bryothamnion triquetrum, Laurencia poitei and Digenia simplex generally support abundant epiphytes. Large plants of Dasya pedicellata, Halymenia floresia and Crysymenia enteromorpha are frequently devoid of epiphytes. On almost all hosts, a general zonation pattern of epiphytes is observed. Epiphytism is heaviest on older portions of host plants. It is lightest near meristematic regions. On favorable hosts, epiphytes are distributed closer to apical tips than on non-favorable hosts, although colonization is heaviest on older portions in both types of hosts. Composition of epiphytic species also commonly differs between young and old portions of algal hosts. On uppermost portions of favorable hosts the most common epiphytic species are Ceramium byssoideum, Polysiphonia havanensis, Calithamnion byssoides and Microcoleus lyngbyaceus; on non-favorable hosts these species are sometimes the only epiphytes present. Proceding from younger to older portions of the host, the colonizing species become more abundant and diverse. Oldest host portions are occasionally totally covered with epiphytes. Here the cover of the calcareous Melobesiacean crust frequently approaches 100%. Coralline red algae Corallina, Jania and Amphiroa commonly grow over the crust. (Harris-Wisconsin)
W80-03797

THE MICRODISTRIBUTION OF EPIPHYTES ON THE LEAVES OF NATURAL AND ARTIFICIAL MACROPHYTES,
McGill Univ., Montreal, (Quebec). Dept. of Biology.
A. Cattaneo.
British Phycological Journal, Vol 13, No 2, p 183-188, June 1978. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Epiphytology, *Artificial substrates, *Laboratory tests, *Microenvironment, *Distribution, Chlorophyta, Epiphytes, Cocconeis placentula, Eunotia spp., Analytical techniques, Coleochaete orbicularis, Coleochaete nitellarum, Diatoms, Leaves, Algae, Colonization, Plant pathology, Macrophytes.

Microdistribution of two diatoms (Cocconeis placentula and Eunotia spp.) and two epiphytic green algae (Coleochaete orbicularis and C. nitellarum) on leaves of Potamogeton richardsonii and on those of plastic aquarium plants was compared. Eunotia spp. and Coleochaete orbicularis were significantly more abundant on the underside of natural leaves while C. nitellarum significantly preferred the upper side. There were no significant differences among these taxa in their colonization of the two sides of artificial leaves; however, C. placentula showed a significant preference for the upper side of plastic leaves but had no similar preferences on natural plants. Differential colonization on the upper side and underside of natural leaves by Eunotia spp. and C. orbicularis is attributed to calcium trioxide incrustation on upper sides of leaves. These incrustations reduced colonization space. Diatoms showed significant preference for edges on both natural and plastic leaves. Intense development of green algae on lamina was noted on plastic leaves only. Preference of colonizing leaf margins by diatoms and green algae is possibly related to more favorable illumination and/or nutrient renewal at those parts of the host leaf. (Harris-Wisconsin)
W80-03798

PHYTOPLANKTON DISTRIBUTION AND LIGHT ATTENUATION IN PORT HACKING ESTUARY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
B. D. Scott.
Australian Journal of Marine and Freshwater Research, Vol 29, No 1, p 31-44, February 1978. 8 Fig, 1 Tab, 20 Ref.

Descriptors: *Phytoplankton, *Distribution, *Attenuation, *Light, *Estuarine environments, Photosynthesis, Port Hacking Estuary, Australia, Australia, Vertical distribution, Horizontal distribution, Chlorophyll-a, Estuaries, Fluorescence, Solar radiation, Detritus, Suspended solids, Sedimentation, Biomass, Spatial distribution.

In-vivo chlorophyll fluorescence, phytoplankton photosynthesis rates at constant irradiance, and solar irradiance attenuation by water columns were measured in sea water samples taken from Port Hacking estuary near Sydney, Australia, in order to obtain phytoplankton distribution patterns. Five general conclusions are derived: (1) Phytoplankton distribution within the South West Arm in Port Hacking estuary is almost uniform horizontally. Vertical distribution is rarely uniform, with manima occuring at depths of 2-6 m. (2) Although horizontal phytoplankton distribution is fairly uniform, distribution can be grouped according to locality and magnitude. The magnitude and similarity of chlorophyll to photosynthesis in ratios of these groups indicates that phytoplankton biomass adjusts so that it is optimal to nutrient flux. (3) Attenuation of solar radiation by the water columns is near uniform both horizontally and vertically, with attenuation coefficients with 10% of the mean value within South West Arm except in times of heavy rainfall when introduced sediments occur in the upper 6 m of the water column. (4) Secimentation removes more than 22% of the suspended sediments and phytoplankton from the water column. (5) Because phytoplankton contribution to the total attenuation coefficient is only 0.013 per meter, the chlorophyll-attenuation relationship is of limited use in estimating optical properties of the water column from chlorophyll measurements. (Harris-Wisconsin)
W80-03799

APPLICATION OF IN SITU CAGE CULTURES OF PHYTOPLANKTON FOR MONITORING HEAVY METAL POLLUTION IN TWO NORWEGIAN FJORDS,
Trondheim Univ., (Norway). Inst. of Marine Biochemistry.
I. Eide, A. Jensen, and S. Melsom.
Journal of Experimental Marine Biology and Ecology, Vol 37, No 3, p 271-286, March 22, 1979. 4 Fig, 6 Tab, 30 Ref.

Descriptors: *On-site data collections, *Heavy metals, *Fjords, *Cultures, *Diatoms, *Research equipment, *Industrial wastes, Monitoring, Sampling, Water pollution sources, Zinc, Lead, Absorption, Cadmium, Mercury, Norway, Orkdalsfjord, Norway, Trondheims-fjord, Norway, Sorfjord, Norway, Hardangerfjord, Norway, Growth rates, Environmental effects.

A simple field apparatus for cage cultivation of marine planktonic algae consist of a perforated Perspex box 35 cm per side rope-suspended by a buoy at one m depth. A rotor with algal cultures contained in dialysis tubing is turned inside the box by an electrically driven sealed magnet. A tube containing a chelating resin and fitted with a filter is also attached; water is drawn continuously through the filter pack and column and stored in a collector flask for exact determination of sampled volume. Three test sites were equipped in each of two Norwegian fjords: Orkdalsfjord (abranch of Trondheimsfjord) along the central Atlantic coast, and the Sorfjord branch of Hardangerfjord about 300 km to the south. Both fjords are point sources of heavy metals loading from metallurgic industries located in the innermost part of the fjord. Averages were obtained for dissolved and particularate heavy metal content at various sites. Zinc, lead, cadmium and mercury showed differences in the proportion of dissolved to particularate fractions. Three species of tested diatoms gave systematic growth responses to heavy metal pollution in the moderately polluted Sorfjord. One alga died and one showed reduced growth rate at the more contaminated site compared with those at less polluted sites, while the most tolerant alga was apparently not affected. Only the most tolerant alga survived in the more heavily polluted fjord, showing decreasing growth rate with increasing pollution. Uptake of heavy metals increased generally with increasing metal content. (Harris-Wisconsin)
W80-03800

PREDICTION OF THE QUALITY OF WATER IN A PROPOSED IMPOUNDMENT IN SOUTHWESTERN WISCONSIN, USA,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-03801

SEASONAL OCCURRENCE AND VARIATION IN STANDING CROP OF A DRIFT ALGAL COMMUNITY IN THE INDIAN RIVER, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
M. C. Benz, N. J. Eiseman, and E. E. Gallaher.
Botanica Marina, Vol 22, No 7, p 413-420, October 1979. 6 Fig, 4 Tab, 16 Ref.

Descriptors: *Standing crops, *Seasonal, *Algae, *Indian River(FL), *Distribution patterns, *Aquatic drift, *Biological communities, *Marsh plants, *Estuaring environments, Biomass, Distribution, Drifting(Aquatic), Regression analysis, Speciation, Variability, Water temperature, Light intensity, Statistical methods, Statistics, Mathematical studies, Salinity, Estuaries, Florida, Grassed waterways.

Observations of a 50 ha seagrass flat near Fort Pierce Inlet on the Indian River, Florida September 1975-August 1976, show highest biomass (12 g dwt/sq m) in spring when water temperatures are 23-27C; light energy 400-500 Langleys/D; and salinity 33-34 ppt. Biomass variation corresponds well to variations in temperature, salinity and light, declining in mid-fall then rising in mid-winter and continuing to increase until onset of the rainy season in May. Biomass remains low during summer when temperature and light energy are highest. Species numbers are highest in September and May and lowest in October and July. Sixty-three species, including epiphytes, were identified: 3 Cyanophyta (5%), 12 Chlorophyta (19%), 9 Phaeophyta (14%), and 39 Rhodophyta (62%). The most common species are Dictoyota dichotoma, Acanthophora specifera, Hypnea cervicornis, H. musciformis and Spyridia filamentosa. Seasonal dominants include brown alga Rosenvingea intricata and red alga Chondria tenuissima. Algal biomass frequency distributions are contagious in September and January - May, suggesting aggregated populations. Little or no drift algae is found in a large number of samples in winter-spring months. In September when biomass is relatively high, contagion is highly significant due to dominance of one species, Acanthophora specifera. Low randomness values in other months suggest distributional regularity. From October to December biomass values decline; all species are present with nearly equal weight and low density, indicating low rendomness. (Danovich-Wisconsin)
W80-03803

TEMPERATURE EFFECTS ON STEADY-STATE GROWTH, PHOSPHORUS UPTAKE, AND THE CHEMICAL COMPOSITION OF A MARINE PHYTOPLANKTER,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Microbial Ecology, Vol 5, No 3, p 153-166, 1979. 6 Fig, 1 Tab, 34 Ref.

Descriptors: *Kinetics, *Nutrient requirements, *Phosphorus, *Temperature, *Chrysophyta, *Growth rates, *Nutrient flux models, Nutrients, Phytoplankton, Monochrysis lutheri, Algae, Cytological studies, Nitrogen, Carbon, Cycling nutrients, Equations, Limiting factors, Laboratory tests, Cultures, Monod equation.

Continuous culture experiments on the marine chrysophyte Monochrysis lutheri under phosphorus limitation in 15-23C temperatures show that phytoplankton growth and limiting-nutrient uptake rates are only synchronous at or near optimum temperature. Temperature effects on nutrient uptake rates are species specific and extremely complicate. Therefore, temperature should not be included as a variable in nutrient flux models. The Arrhenius equation well describes the response of phytoplankton maximum growth rates to temperature. Temperature effects on cell quota and steady-state phosphorus uptake rates during phosphorus limitation are much more complicated than similar effects on growth rates. M. lutheri growth and uptake are synchronous between 18.8 and 23C; however, a doubling in phosphorus cell quota at 15C leads to a significant uncoupling between growth and assimilation processes. While phosphorus uptake rate on a cell basis increases dramatically at 15C, turnover rates of total available phosphorus are unaffected by temperature. If the specific growth rate is constant at 0.20/d, phosphorus nutrient uptakes rates are 0.005-0.006 pg P/cell d between 18.8-23C, but are 0.011 pg P/cell d at 15C. Carbon and nitrogen cell quotas are relatively invariant with growth rate at each temperature; uptake rates are not nearly as affected at 15C as phosphorus uptake rates. However, nitrogen uptake is accelerated at 23C which is close to optimum temperature, stripping both nitrogen and phosphorus from solution. (Danovich-Wisconsin)
W80-03804

TWO PHASES OF THE PHYTOPLANKTON COMMUNITY IN THE BAJA CALIFORNIA UPWELLING,
Instituto Investigaciones Pesqueras, Barcelona (Spain).
M. Estrada, and D. Blasco.
Limnology and Oceanography, Vol 24, No 6, p 1065-1080, November 1979. 11 Fig, 3 Tab.

Descriptors: *Phytoplankton, *Principal component analysis, *Red tide, *Marine algae, Statistical methods, MESCAL I, MESCAL II, Punta San Hipolito, Baja California, Mexico, Dinoflagellates, Salinity, Upwelling, California Current, California Undercurrent.

Principal component analysis was applied to quantitative data on 60 phytoplankton species collected during cruises of MESCAL I and MESCAL II of Punta San Hipolito, Baja California March 1972 and March-May 1973, respectively. Higher positive values of the dinoflagellate component correspond to areas of relatively low salinity and high nutrient concentrations, associated with upwelling water from below the minimum salinity core of the California Current. Diatom dominance is related to upwelling of deeper saline and high nutrient water from the California Undercurrent. Species with highest loadings in the analysis of MESCAL I data are predominantly dinoflagellates. The first principal component is related to the red tide that occupied the area during the first cruise. Gonyaulax polyedra with a correlation coefficient of 0.88 with the first principal component is the dominant species. During MESCAL II no red tide was seen, but the ordination of species according to loadings is indicated in the presence of red tide. Loadings of the second principal component of MESCAL II are similar to loadings of the first principal component of MESCAL I, suggesting that these components can be jointly considered and represent a persistent pattern in phytoplankton composition. Distribution of the dinoflagellate bloom component shows patterns very similar to that of salinity. (Harris-Wisconsin)
W80-03805

PHOTOSYNTHESIS IN THE AQUATIC MACROPHYTE EGERIA DENSA. III GAS EXCHANGE STUDIES,
Auckland Univ. (New Zealand). Dept. of Botany.
J. A. Browse, F. I. Dromgoole, and J. M. A. Brown.
Australian Journal of Plant Physiology, Vol 6, No 4, p 499-512, August 1979. 6 Fig, 2 Tab, 43 Ref.

Descriptors: *Photosynthesis, *Absorption, *Egeria densa, *Infrared gas analysis, Analytical techniques, Submerged plants, Bicarbonates, Carbon dioxide, Inorganic compounds, Aquatic plants, Gases, Resistance, Kinetics, Cytological studies, Macrophytes, Gas chromatography, Biochemistry.

Infrared gas analysis techniques were used to study inorganic carbon uptake by Egeria densa. The CO2 response of photosynthesis in this plant is analyzed in terms of the resistance concept used in terrestial plant studies; the extent to which becarbonate ions contribute to photosynthesis is also assessed. Data for photosynthesis at various free CO2 concentrations and 4.5 pH show that carbon fixation by E. densa is saturated only at very high free CO2 concentrations (about 400 um), corresponding to 1% CO2 in the gas phase. Carboxylation and mesophyll resistances, 3800 s/m and 9000 s/m, respectively, in E. Densa are considerably higher than in aerial plant leaves. The boundary layer is the highest component (greater than 27,000 s/m) of total resistance. Closed and open-circuit gas exchange experiments demonstrate that bicarbonate is taken up by plant cells and does not act merely as an inorganic carbon reservoir for CO2 production at the plasmalemma. Bicarbonate stimulation activates photosynthesis, even when free CO2 concentration is below the CO2 compensation point. The total resistance of bicarbonate uptake is 8-12 times that of CO2 uptake, not as a result of CO2 assimilation but rather as a result of active uptake, transport and conversion of CO2 involved in bicarbonate. (Harris-Wisconsin)
W80-03806

ZOOPLANKTON IN A QUASI-STABLE PHASE IN AN ENDORHEIC LAKE (LAKE CHILWA, MALAWI),
University of the Witwaterstrand, Johannesburg (South Africa).
M. Kalk.
Hydrobiologia, Vol 66, No 1, p 7-15, September 1979. 4 Fig, 27 Ref.

Descriptors: *Zooplankton, *Lake Chilwa, Malawi, *Water level fluctuations, *Population dynamics, *Density, *Distribution, Tropodiaptomus kraepelini, Diaphanosoma excisum, Daphnia barbata, Seasonal, Dominant organisms, Water levels, Turbidity, Light penetration, Population, Speciation, Crustaceans, Filter feeders, Predation, Salinity, Algae, Plant growth.

Zooplankton density and distribution in Lake Chilwa, Malawi, was stable 1975-1976; this 700 sq km shallow endorheic lake dried up completely in 1968 and filled up again a year later. Year-around dominant species are Tropodiaptomus kraepelini and Diaphanosoma excisum, with additional dominance by Daphnia barbata during cooler dry months. These facultative feeders utilize detritus washed from the decay of Typha in surrounding swamps. Low numbers or total exclusion of other zooplankton species common in permanent African lakes, is attributed to limited quantities of green algae, submerged vascular plants, and blue-green algae which are not abundant because of prevailing high turbidity and low light penetration. Heavy fish predation of larger (>1.5 mm) zooplankton also occurs. Although a hundred-fold seasonal variation in density of zooplankton occurs, numbers stabilize in the coldest month with D. barbata compensating for loss of other dominant species. Three-fold dilution of the lake with rains and the corresponding change in salinity does not affect zooplankton density. (Harris-Wisconsin)
W80-03807

INFLUENCE OF THE SHELF-BREAK FRONT OFF NOVA SCOTIA ON PHYTOPLANKTON STANDING STOCK IN WINTER,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
R. O. Fournier, M. Van Det, J. S. Wilson, and N. B. Hargreaves.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1228-1237, October 1979. 6 Fig, 4 Tab, 30 Ref.

Descriptors: *Phytoplankton, *Boundaries(Surfaces), *Productivity, *Continental slope, *Population dynamics, *Destratification, Nova Scotia, Turbulent boundary layers, Standing crops, Biomass, Temperature, Salinity, Chlorophyll-a, Continental shelf, Primary productivity, Mixing, Winter, Light, Light intensity, Population, Stratification.

Observations of phytoplankton in the shelf-break front off the coast of Nova Scotia were made during winters of 1977 and 1978. Chlorophyll-a in the euphotic zone correlates with the inclination of the surface front. It was concluded that the steep-

ness of the front influences the depth of phytoplankton mixing by controlling illumination received by individual cells. Two extremes of the subsurface front were apparent in experimental observations: a vertical extreme containing very little phytoplankton biomass; and horizontal extreme containing significant quantities of chlorophyll. Mathematical estimates were made on how various magnitudes of decreased frontal inclination and corresponding magnitudes of shallowing of mixed layers increase phytoplankton production. Shallowing of the mixed layer to less than 25 meters produces chlorophyll increases equivalent to that observed at 8 m. Reducing the mixed layer to 17.5 m yields the maximum rate of augmentation of new plant material. The number of 5-day intervals necessary to achieve a 25% increase in growth declines from 21 at 35 m to 6.6 at 15 m. A reduction in the depth of the mixed layer to between 15 and 20 m causes rapid increases in chlorophyll. (Harris-Wisconsin)
W80-03809

TWO ELECTIVITY INDICES FOR FEEDING WITH SPECIAL REFERENCE TO ZOOPLANKTON GRAZING,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
H. A. Vanderploeg, and D. Scavia.
Journal of the Fisheries Research Board of Canada, Vol 36, No 4, p 362-365, April 1979. 3 Fig, 11 Ref.

Descriptors: *Grazing, *Zooplankton, *Analytical techniques, *Food chains, *Food habits, Feeding rates, Indices, Mathematical models, Secondary productivity, Estimating equations, Particle size, Particle shape, Foods, Equations, Curves, Mathematical studies.

Two electivity indices which have been commonly used to quantify size-selective grazing by zooplankton are shown to be inefficient in answering two grazing-related research questions: First, are particles of certain sizes 'selected' in preference to others. Second, does this selection depend on the shape of the particle-size spectrum of the food offered. Under conditions of passive mechanical particle-size selection, these indices yield electivity vs. particle-size curves that vary with the shape of the particle-size spectrum of food offered to zooplankton. In addition to this bias, poor electivity estimates are obtained unless only a small fraction of food is eaten in such experiments. A new electivity index is recommended in place of one of the standard indices to quantify feeding zooplankton preferences; a measurement in which the new index is held constant. The new index is calculated from filtering rates or mortality rates. Not only can size selection be investigated with these indices, but also preferences based on taste or other factors. (Harris-Wisconsin)
W80-03810

SEASONAL CHANGES OF BACTERIOPLANKTON IN A RESERVOIR RELATED TO ALGAE. I. NUMBERS AND BIOMASS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
V. Straskrabova, and J. Komarkova.
Internationale Revue der Gesamten Hydrobiologie, Vol 64, No 3, p 285-302, 1979. 10 Fig, 9 Tab, 33 Ref.

Descriptors: *Bacteria, *Potable water, *Klicava Reservoir, Czechoslovakia, *Biomass, *Algae, *Seasonal, *Population dynamics, Microorganisms, Reservoirs, Environmental sanitation, Impoundments, Zooplankton, Seasonal, Distribution, Organic compounds, Carbon, Biodegradation, Population, Plankton.

Samples of drinking water supply from Klicava Reservoir near Prague, Czechoslovakia were collected at ten-day intervals March-October, 1967. Changes in bacterial counts and algal biomass show a similar pattern. Four bacterial peaks occur during the season, either coinciding with algal maxima or occurring ten days later. In July, both bacterial and algal numbers decrease sharply. Average volumes of bacterial cells, corrected for shrinkage, are mostly lower than 0.2 cv micro m. The largest bacterial cell volumes and their greatest variability occur August - October. Bacteria in clusters of four or more cells account for 20% of the total count. The maximum concentration of bacterial biomass at the surface is 0.38 cv micro m/l with mean values 0.8 - 0.10 micro m/l. Bacterial carbon averages 4 - 40% of algal carbon, and about 50% of zooplankton carbon. Dissolved organic carbon is 2 - 3 times higher than that of bacterioplankton, thus suggesting resistance of most dissolved organic compounds to bacterial decomposition. (Harris-Wisconsin)
W80-03811

ANEROBIC METABOLISM OF IMMEDIATE METHANE PRECURSORS IN LAKE MENDOTA,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
M. R. Winfrey, and J. G. Zeikus.
Applied and Environmental Microbiology, Vol 37, No 2, p 244-253, February, 1979. 5 Fig, 4 Tab, 36 Ref. NSF DEB 73-01511-A01 and DEB 782-4071.

Descriptors: *Methane bacteria, *Metabolism, *Lake Mendota(WI), *Limiting factors, *Anaerobic conditions, *Microbial degradation, Microbiology, Sediments, Water chemistry, Seasonal, Competition, Sediment-water interfaces, Anaerobic bacteria, Methane, Carbon dioxide, Decomposing organic matter, Degradation(Decomposition), Stratification, Turnovers, Microorganisms, Substrates.

Methanogenesis in Lake Mendota, Wisconsin sediments is limited by immediate methane precursor availability (acetate and hydrogen), by competition for these substrates by nonmethanogens, and by seasonal variations which alter sediment and water chemistry. During stratification, methanogenesis is observed in waters overlying sediments, but during turnovers, it is first detected several centimeters below the sediment-water interface. During turnover, oxygenated water is mixed throughout the water column and oxygen-sensitive methanogens are inhibited. Due to extremely small acetate pool size (3.5 micro M) in Lake Mendota, competition for this energy source between methane and acetate-oxidizing organisms may greatly affect methano-genesis. Acetate and hydrogen pool sizes are very small and turn over rapidly in sediments (0.22 for acetate). The dissolved inorganic carbon pool is large (6.4-8.3 mM) however, and turnover time is slow (111 h). In Lake Mendota sediments the rate-limiting step in methanogenesis is the rate at which hydrogen and acetate are supplied to the small methane precursor pool. Both hydrogen/carbon dioxide and acetate are simultaneously converted to methane in sediments, even with excess hydrogen or acetate present. In Lake Mendota sediments, 41% of the methane is derived from HCO3-C. Based on the assumption that CO2 and acetate alone are methane-C precursors in nature, 59% of the methane is formed from acetate. (Danovich-Wisconsin)
W80-03812

MICROBIAL METHANOGENESIS AND ACETATE METABOLISM IN A MEROMICTIC LAKE,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
For primary bibliographic entry see Field 2H.
W80-03813

A NINE-YEAR STUDY OF THE PHYTOPLANKTON OF THE EUTROPHIC AND NONSTRATIFYING LOCH LEVEN (KINROSS, SCOTLAND),
Institute of Terrestial Ecology, Edinburgh (Scotland). Plankton Ecology Project Group.
A. E. Bailey-Watts.
The Journal of Ecology, Vol 66, No 3, p 741-771, November 1979. 14 Fig, 7 Tab, 90 Ref.

Descriptors: *Loch Leven, Scotland, *Eutrophication, *Phytoplankton, *Water pollution effects, *Organic loading, Nonpoint sources, Lakes, Daphnia hyalina, Zooplankton, Cyclops strenuus abyssorum, Sampling, Nitrates, Fertilizers, Oscillatoria agardhii, Chlorophyll-a, Plant populations, Distribution patterns, Density, Aquatic algae, Baseline data, Size, Phosphates.

Qualitative and quantitative changes are described which occured in phytoplankton populations of shallow, eutrophic and non-stratifying Loch Leven, located in a catchment area of 70% arable land in Scotland's Plain of Kinross with heavy loadings of nitrates from agricultural fertilizers. Sampling conducted weekly 1968-1976 showed marked seasonal and annual differences in species composition and population densities. Four trends were substantiated by the nine years of sampling: (1) Although dry weight and phytoplankton totals decreased temporarily in 1976 (coincidental with massive growth of a pale form of Oscillatoria agardhii Gomont), these two measures and chlorophyll-a concentrations all decreased over the full sampling period. (2) Dominant algae size increased and the total number of individuals producing various population maxima decreased; a 3000-fold increase in size accompanied the change toward large species which replaced nannoplankton forms. Earlier measurements of 100,000-1,000,000 individuals/ml were reduced to population maxima of 10,000/ml in later measurements. (3) The continual changes in species composition were associated with strong variations in percentage of chlorophyll-a of crop dry weight and ratios of chlorophyll-a to volume, and of dry weight to volume. (4) After 1972, phosphorus loadings were reduced approximately 1.0 g sq m/yr; the reduction is thought to be related to a shift in the zooplankton community from domination by Cyclops to domination by Daphnia. (Harris-Wisconsin)
W80-03816

CONSUMPTION OF EELGRASS, ZOSTERA MARINA, BY BIRDS AND INVERTEBRATES DURING THE GROWING SEASON IN LAKE GREVELINGEN (SW NETHERLANDS),
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
P. H. Nienhuis, and E. T. Van Ierland.
Netherlands Journal of Sea Research, Vol 12, No 2, p 180-194, November 1978. 3 Fig, 3 Tab, 33 Ref.

Descriptors: *Food chains, *Waterfowl, *Isopods, *Eelgrass, *Coastal marshes, *Lake Grevelingen, Netherlands, Zostera marina, Brackish water, Estuarine environment, Europe, Temperate, Detritus, Aquatic plants, Primary productivity, Temperate, Birds, Foods.

Findings from a study conducted May-August 1976 in Lake Grevelingen, The Netherlands, supported hypotheses developed earlier that in temperate latitudes few animal species use eelgrass (Zostera Marina L.) as a food source; eelgrass yields only a small fraction of its production to grazing food chains and the remainder enters detritus food chains. The plant is found in temperate marine and brackish coastal waters throughout the northern hemisphere, but the Grevelingen eelgrass population is the only significant stand of this plant on the European continental coast from northern France to Denmark. Sampling shows that eelgrass provides quantifiable food amounts to five bird species (Cygnus olor, Branta bernicla, Fulica atra, Aythya ferina and Anas platyrhynchos) and one invertebrate species, the isopod Idotea chelipes. Total eelgrass consumption amounts to 0.839 g C sq m for all of Lake Grevelingen. Birds consume 23% of the total and isopods, 77%. A modest estimate is that only 3.7% of the living eelgrass production (23 g C sq m) in Lake Grevelingen is consumed by birds and Idotea. However, the actual percentage of the eelgrass eaten by these macroconsumers may be slightly larger, about 1.486 g C sq m or 6.5% of the eelgrass production. The remaining 93.5% of living eelgrass production enters the detritus chain. (Harris-Wisconsin)
W80-03819

SPECIES COMPOSITION AND SEASONAL OCCURENCE OF CENTRIC DIATOMS IN A POLLUTED MARINE ENVIRONMENT,
Karachi Univ. (Pakistan). Inst. of Marine Biology.
S. M. Saifullah, and M. Moazzam.
Pakistan Journal of Botany, Vol 10, No 1, p 53-64,

June 1978. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Karachi, Pakistan, *Diatoms, *Speciation, *Harbors, *Estuarine environments, Bioindicators, Marine microorganisms, Arabian Gulf, Indian Ocean, Lyari River, Karachi(Pakistan), Varieties, Systematics, Chaetoceros, Rhizosolenia, Coscinodiscus, Ports, Coasts, Estuaries, Intertidal areas, Seasonal, Mixing, Distribution, Spatial distribution, Temporal distribution, Lower Harbour(Karachi-Pakistan).

The richness of species diversity among marine centric diatoms in the highly polluted Lower Harbour of Karachi, Pakistan on the Arabian Sea may be accounted for by mixing in the harbor of water from the Lyari River with water from the coastal shelf. In sampling conducted April 1970 - November 1971 and October 1972 - June 1973, 101 species and six varieties belonging to 30 genera were recorded; these results compare with 25 genera, 81 species and nine varieties reported from the Pakistan shelf and the Arabian Sea in an earlier study; difference in total numbers between the two localities is thus negligible. Chaetoceros and Rhizosolenia are the most diverse genera, however, Coscinodiscus, the third most diverse genus, is represented by 13 species in the Lower Harbour but only three species in the coastal shelf. These three genera are also dominant on the west coast of India, but Coscinodiscus ranks second and Rhizosolenia third in species numbers. No relation is established between salinity and auxospore formation. Spatial distribution of diatoms in the Lower Harbour is even more irregular than temporal distribution. In addition to pollution and other environmental perturbations in the Lower Harbour, semidiurnal tides and dredging operations are also considered responsible for irregularity in diatom temporal and spatial distribution. (Harris-Wisconsin)
W80-03820

LIGHT STIMULATION OF PHOSPHATE UPTAKE IN NATURAL ASSEMBLAGES OF PHYTOPLANKTON,
Moss Landing Marine Lab., CA.
S. J. Reshkin, and G. A. Knauer.
Limnology and Oceanography, Vol 24, No 6, p 1121-1124, November 1979. 1 Fig, 1 Tab, 27 Ref.

Descriptors: *Light intensity, *Phytoplankton, *Phosphates, *Michaelis-Menten equations, *Nutrient requirements, Light, Nutrients, Kinetics, Darkness, Algae, Nitrates, Ammonia, Regression analysis, Monterey Bay(CA), Phosphorus, Nitrogen, Ecology.

Dark uptake-corrected light half-saturation constants for surface phytoplankton samples collected offshore Monterey Bay, California range 11.3-18.3% of incident light and are comparable in some instances to those found for light-dependent nitrate and ammonium uptake. Results suggest that phosphate uptake rates can be approximated by Michaelis-Menten rectangular hyperbolic function in terms of percent incident light intensity. However, it is unlikely that uptake rates for nitrogen and phosphorus are similar, since nitrogen is incorporated into phytoplankton tissue at a ratio of 16:1 relative to phosphorus. Half-saturation constants using dark bottles average 4.2% of surface light intensity; dark uptake contributes a significant amount to total uptake rates, ranging 29-33%. When dark uptake rates are subtracted from various light treatments, half-saturation constants are significantly higher, ranging 11.3%-18.3%. These average values are not unexpected; other studies have produced similar results. These observations, together with the importance of phosphorus to primary production, emphasize the ecological importance of phytoplankton being able to assimilate phosphate at relatively low light intensities. (Danovich-Wisconsin)
W80-03821

DISTRIBUTION OF BACTERIA AND CHLOROPHYLL A AT A NEARSHORE STATION IN LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
S. S. Rao, R. E. Kwiatkowski, and A. A. Jurkovic.
Hydrobiologia, Vol 66, No 1, p 33-39, September 1979. 3 Fig, 4 Tab, 14 Ref.

Descriptors: *Lake Ontario, *Chlorophyll, *Bacteria, *Water temperature, *Organic compounds, Regression analysis, Distribution, Organic matter, Nitrogen, Carbon, Seasonal, Speciation, Biomass, Variability, Depth, Spatial distribution, Temporal distribution, Algae.

Relationships between bacteria and chlorophyll-a seasonal distribution are related to particulate organic carbon (POC), total particulate nitrogen (TPN), and temperature in a nearshore area in Lake Ontario, studied April-November 1977; regression analysis indicates that 45-65% of the total bacterial variability is explained by POC and temperature. A relationship between high chlorophyll-a and low bacteria exists in early spring-September at which time an inverse relationship results. Diatoms are the dominant algal group during summer. In late September bacteria: chlorophyll-a ratio is 50:2 and total bacteria: POC is 35:8. High bacteria - chlorophyll-a ratio peaks in October because of declining temperatures (6C) which result in low chlorophyll-a values but high psychophilic bacterial populations. Regression analysis indicates that chlorophyll-a, POC, TPN and temperature significantly correlate to total bacterial biomass. Chlorophyll-a, POC and TPN highly correlate with one another at all depts. Temperature significantly correlates with POC and TPN only at 1 m depth, but significantly correlates with total bacteria at all depths. Total bacteria significantly correlates with chlorophyll-a and POC at 5 m and 10 m and with TPN at 10 m. Algal community composition (diatom versus non-diatom) also plays an important role in controlling bacterial biomass. (Danovich-Wisconsin)
W80-03822

SEASONAL SUCCESSION OF PHYTOPLANKTON IN A LARGE SUBARCTIC RIVER,
J. W. Moore.
Hydrobiologia, Vol 67, No 2, p 107-112, November 1979. 3 Fig, 19 Ref.

Descriptors: *Yellowknife River(Canada), Northwest Territories, Canada, *Phytoplankton, *Succession, *Subarctic, *Population dynamics, Chlamydomonas, Diatoms, Dinobryon, Light, Light intensity, Nutrients, Water temperature, Seasonal, Limiting factors, Speciation, Dominant organisms, Nitrogen, Phosphorus, Silica.

Seasonal changes in density of common phytoplankton species in the Yellowknife River of subarctic Canada are described; samples were collected every 1-2 weeks June 1975-November 1978. Initiation of the spring bloom in April is due to changing light conditions. Temperatures are constant (0C) and nutrient concentrations are both high and constant. Day length, however, was increasing rapidly (>6 min/d) and coincided with continual reduction in depth of snow and ice cover. Total phosphorus and nitrate levels decrease significantly during May-June, coincident with Chlamydomonas lapponica growth. Chlamydomonas is replaced during early summer by a rapid succession of Dinobryon species in which D. cylindricum is followed by D. sociale and in turn by D. bavaricum and D. divergens. The gradual appearance of diatoms in the river during June coincides with decreased Si02 concentrations. Thereafter, Si02 levels remain low (<0.1 g/cu m) and limit development. Dinobryon species rapidly decrease in August and September. Phytoplankton do not increase in numbers during the fall due to low temperatures and nutrient levels. Nutrient recycling does not occur until late in the season when water temperatures are 0-1C. Yellowknife River is 250 km in length. Samples were collected from the river mouth where water depth is 5-8 m and current velocity is 0-5 cm/s. (Danovich-Wisconsin)
W80-03824

MANAGEMENT OF ELODEA IN AUSTRALIAN IRRIGATION SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03825

A NEW APPROACH FOR SALVINIA CONTROL,
Queensland Dept. of Lands, Brisbane (Australia).
For primary bibliographic entry see Field 4A.
W80-03827

THE USE OF MULTIPLE INVERSION AND CLEAN-FLO LAKE CLEANSER IN CONTROLLING AQUATIC PLANTS,
Clean-Flo Labs., Inc., Hopkins, MN.
For primary bibliographic entry see Field 4A.
W80-03828

ESTABLISHMENT OF WATERHYACINTH WEEVIL POPULATIONS IN LOUISIANA,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
For primary bibliographic entry see Field 4A.
W80-03829

BIOLOGICAL CONTROL OF HYDRILLA VERTICILLATA ROYLE WITH GRASS CARP (CTENOPHARYNGODON IDELLA VAL),
University of Central Florida, Orlando. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W80-03830

SEASONAL VARIATION IN THE BIOMASS, TUBER DENSITY, AND PHOTOSYNTHETIC METABOLISM OF HYDRILLA IN THREE FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Botany; and Florida Univ., Gainesville. Dept. of Agronomy.
G. Bowes, A. S. Holaday, and W. T. Haller.
Journal of Aquatic Plant Management, Vol 17, p 61-65, June 1979. 1 Fig, 8 Tab, 17 Ref.

Descriptors: *Seasonal, *Jackson Lake(FL), Orange Lake(FL), *Trafford Lake(FL), *Aquatic weeds, *Plant physiology, Biomass, Aquatic plants, Metabolism, Primary productivity, Photosynthesis, Respiration, Macrophytes, Eutrophication, Carbon dioxide, Spatial distribution, Plant populations, Aquatic environment, Vegetation regrowth, Root systems, Aquatic weed control.

Lake Trafford in southern Florida has higher year-long biomass and tuber density than Jackson and Orange Lakes in northern Florida, 1977, implying that hydrilla control may require more frequent treatments and will be more expensive in southern Florida than in northern Florida. Mats are not present in winter in northern Lakes Jackson and Orange; maximum 0.24 kg dwt/sq m mat biomass occurs in late fall. In southern Lake Trafford, mats are present year round with 0.89 kg dwt/sq m summer biomass maximum. Tuber densities peak in late fall in Lakes Jackson and Orange whereas in Lake Trafford they remain high throughout the year. Dense hydrilla mat structure, as contrasted with open water, substantially changes the aquatic environment. Light levels are reduced below the photosynthetic light compensation point 0.3m below mats, open water light levels are above the compensation point to 1.3 m depths. Hydrilla reduces mixing, allowing daytime temperatures, oxygen concentration and pH to rise to values higher than in open areas. Net hydrilla photosynthesis is lowest during winter, but increases February to May in Orange and Trafford Lakes. Seasonal variation in the C02 compensation point is large (17-90 micro 1 C02/1) for hydrilla in all three lakes. Values are highest in winter and lowest in spring. Such dramatic seasonal shifts in photosynthetic/ photorespiratory metabolism has not been reported with any terrestrial plants, suggesting that submersed aquatic macrophtes are a unique photosynthetic group. (Danovich-Wisconsin)
W80-03834

BRITISH COLUMBIA AQUATIC PLANT MANAGEMENT PROGRAM,

Department of the Environment, Victoria (British Columbia).
For primary bibliographic entry see Field 4A.
W80-03840

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
For primary bibliographic entry see Field 6E.
W80-03857

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2I.
W80-03866

COMPOSITION AND ABUNDANCE OF PHYTOPLANKTON IN TRIBUTARIES OF THE LOWER COLORADO RIVER, GRAND CANYON REGION,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
W. M. Crayton, and M. R. Sommerfeld.
Hydrobiologia, Vol 66, No 1, p 81-93, September 1979. 2 Fig, 1 Tab, 34 Ref.

Descriptors: *Phytoplankton, *Colorado River, *Grand Canyon(AR-UT), *Baseline studies, *Physicochemical properties, Wild rivers, Rivers, Algae, Speciation, Diatoms, Sampling, Tributaries, Basic data collections, Variability, Intermittent streams, Water sources, Streams, Streamflow.

During April 1975-June 1976, physicochemical characteristeristics were analyzed and phytoplankton samples were collected at mouths of 11 tributaries of the Colorado River within the Grand Canyon. A total of 56 genera and 156 phytoplankton species were identified. Phytoplankton compositions of the tributaries are distinct; only four diatoms are common to all tributaries: Diatoma vulgare, Navicula tripuncata, Nitzschia linearis, and Synedra ulna. Abundance and variability are relatively low in all tributaries; this could reflect physicochemical changes such as the limited age of the water resulting from the short source to mouth distance, and high stream turbidity, sediment content, and current velocity. Bright Angel Creek, Shinumo Creek, and Elves Chasm exhibit the greatest species variability, while Elves Chasm and Diamond Creek have the greatest phytoplankton abundance. Several dominant algal species, Biddulphia laevis, Cocconeis pediculus, Cymbella ventricosa, Epithemia sorex, Gomphonema parvulum and Synedra ulna correlate with certain physicochemical attributes of creek water, such as temperature, pH, TDS, nitrate, calcium and potassium. (Harris-Wisconsin)
W80-03890

EFFECTS OF MINE DRAINAGE ON THE RIVER HAYLE, CORNWALL (A) FACTORS AFFECTING CONCENTRATIONS OF COPPER, ZINC AND IRON IN WATER, SEDIMENTS AND DOMINANT INVERTEBRATE FAUNA,
Cambridge Univ. (England). Dept. of Applied Biology.
B. E. Brown.
Hydrobiologia, Vol 52, No 2-3, p 221-233, February, 1977. 7 Fig, 6 Tab, 38 Ref.

Descriptors: *Water quality, *River Hayle(UK), United Kingdom, *Heavy metals, *Mine drainage, *Sediments, *Invertebrates, Cornwall, Mineral industry, Mine water, Copper, Iron, Zinc, Bioaccumulation, Benthic fauna, Environmental effects, Speciation, Biomass, Seasonal, Diptera, Larvae, Aquatic insects.

This paper describes heavy metal levels in waters, sediments and invertebrate fauna of the River Hayle, situated in the Cornwall mining district, Great Britain, 1973. Several species of Trichoptera, Odonata, Plecoptera and Diptera larvae and adult Coleoptera are present at sites above and below mining influence; however, Mollusca, Hirudinea, Oligochaeta, Crustacea and Platyhelminthes numbers are reduced at downstream sites polluted by mine drainage entry, very few invertebrate species occur. Species diversity is also reduced in the lower river. Highest metal levels are recorded in free-living Trichoptera larvae followed by Plecoptera, Odonata, Neuroptera larvae and finally adult Coleoptera. Water analysis results show that iron is the most abundant metal reaching 6 mg/l, followed by zinc (2.4 mg/l maximum) and then copper (0.7 mg/l maximum). 70% of all copper and iron is particulate whereas 80% of all zinc is soluble. Seasonal differences in total metal content suggest that metal concentrations increase during high flow and decrease during low flow. In sediments iron is the most abundant metal, followed by copper and then zinc. Copper concentrations exceed zinc in sediments probably because clay has a greater affinity for heavier divalent cations. Sediment copper concentrations increase markedly in summer. Ratios of available to total metal present in sediments show that the sequence of exchangeable metals is Zn > Cu > Fe. (Danovich-Wisconsin)
W80-03891

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2K.
W80-03893

ORGANOCHLORINE INSECTICIDES AND PCBS IN SEDIMENTS OF LAKE ST. CLAIR (1970 AND 1974) AND LAKE ERIE (1971),
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
R. Frank, M. Holdrinet, H. E. Braun, R. L. Thomas, and A. L. W. Kemp.
The Science of the Total Environment, Vol 8, p 205-227, 1977. 8 Fig, 6 Tab, 24 Ref.

Descriptors: *Sediments, *Lake St. Claire, *Lake Erie, *Insecticides, Great Lakes, Polychlorinated byphenyls, Pollutants, Organochlorine compounds, Chlorinated hydrocarbon pesticides, Organic pesticides, DDT, DDE, DDD, Pesticide residues, Water pollution sources, Distribution, Detroit River, Aldrin, Spatial distribution, Path of pollutants.

Insecticide residues are usually highest in sediments from Lake Erie's western basin and lowest in Lake St. Claire. Mean residue values in Lake St. Claire surface sediment also decreased significantly 1970-1974. In 1970, mean DDT residue was 6.6 ppb and by 1974, residues declined to 2.4 ppb. TDE was the major component of DDT residues (> 50%), followed by DDE (30%). In 1970, mean HEOD residue in Lake St. Claire was 0.1 ppb and only 24% of samples contained detectable residues. Mean PCB residues were 19 ppb in 1970 and 10 ppb in 1974. Residue spatial distribution in Lake Erie sediments show higher concentrations in basin deposits near the Detroit River and Western Basin. HEOD levels in suspended solids were 3.6 ppb in the Detroit River compared to 1.2 ppb in Lake Erie. PCBs in suspended solids of the Detroit River were 72 ppb but ranged 30-100 ppb; Lake Erie mean PCB residue was 95 ppb. Mean DDT residue in Detroit River suspended solids was 18.5 ppb; mean DDT residue in Lake Erie was 27.9 ppb. In Lake Erie, TDE was the predeominant DDT component with 18.4 ppb mean residue and values ranged 0.3-186 ppb. DDE averaged 8.2 ppb and ranged 0.2-136 ppb. Lake Erie DDT mean residues in the Western Basin were 70.3 ppb, in Sandusky Basin, 15.9 ppb and in the Eastern Basin, 30.4 ppb. With 7.6 mm/yr sedimentation rate, DDT first appeared in 1958, HEOD in 1953 and PCB in 1956; data are compatible with known usage patterns, indicating a 2-5 year lag period after widespread use began. (Danovich-Wisconsin)
W80-03894

EFFECTS OF OIL ON MARINE PHYTOPLANKTON COMMUNITIES,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, T. Chapman, and R. A. Neve.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 263-279, August 1979. 6 Fig, 4 Tab, 9 Ref. Proc of 29th Alaska Science Conference, held Fairbanks, Alaska 15-17 August 1978.

Descriptors: *Oil pollution, *Water pollution effects, *Phytoplankton, *Environmental effects, Baseline studies, Ecosystems, Resources development, *Outer Continental Shelf, Petroleum hydrocarbons.

A series of experiments was conducted at the Seward Marine Station of the Institute of Marine Science, University of Alaska, to determine the effects of low concentrations of petroleum hydrocarbons on marine phytoplankton. The aim was to simulate a natural bloom by using open air swimming pools with flow-through of deep nutrient-rich water pumped from Resurrection Bay and exposed to natural light. Oil was introduced in the inflow of two of three pools at rates designed to produce concentrations of 10 to 50 ppm, while a third pool remained uncontaminated as a control. Observations were designed to detect differences in photosynthesis and phytoplankton population composition between the control and oil impacted pools. Experiments were run over ten day periods. Apart from some minor suppression of photosynthesis, there were no significant changes in phytoplankton activity or population composition. The effects were considered insignificant in terms of overall ecosystem impact. This is in contrast with findings from short-term bioassay experiments in small volume containers. In general, the results support the conclusion that effects of oil spills on pelagic phytoplankton populations are likely to be trivial. (Sinha-OEIS)
W80-03895

AN OVERVIEW OF OFFSHORE ENVIRONMENTAL POLLUTION LAWS AND REGULATIONS IN CANADA, GREENLAND, AND THE NORTH SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
W. M. Sackinger.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 577-591, August 1979. 88 Ref, Proc of 29th Alaska Science Conference, held Fairbanks, Alaska, 15-17 August 1978.

Descriptors: *Oil pollution, *Legislation, *Regulation, *Arctic, *Water pollution, Canada, Alaska, Resources development, Environmental effects, Monitoring, *Outer Continental Shelf, Greenland, North Sea.

The search for offshore petroleum deposits in Arctic and sub-Arctic waters around the world has led many nations to review their legislation dealing with oil pollution incidents at sea. In some cases, legislation originally intended to deal with tanker spills and ballast discharge has been supplemented with specific measures directed at offshore drilling and production operations. Some nations have promulgated regulations which are very specific, while others have managed offshore activities by allowing administrative exceptions to very general rules, based upon an operator's proposed work plan. A brief review of pertinent provisions in the international law covering oil discharges at sea is given, followed by an outline of the framework of environmental pollution law and regulations in Canada, Greenland, and the North Sea. The governmental structure and political terms of reference within which these laws and regulations are enforced is described. Finally, some implications of these findings for the developing Alaskan Outer Continental Shelf, are included. (Sinha-OEIS)
W80-03896

THE TRANSFER OF CADMIUM FROM MARINE HETEROTROPHIC BACTERIA TO MACOMA BALTHICA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. L. Weihs, and D. C. Burrell.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 609-615, August 1979. 2 Fig, 1 Tab, 33 Ref.

Proc of 29th Alaska Science Conference, held Fairbanks, Alaska, 15-17 August 1978.

Descriptors: *Water pollution effects, *Cadmium, *Bacteria, *Food chains, *Environmental effects, Baseline studies, Resources development, Clams, Oil pollution, Metals, *Outer Continental Shelf, Macoma balthica.

A major portion of the renewable resources of Alaska is dependent upon clams. Apart from being themselves exploitable, clams appear to be a major food source for the commercial crabs (and also for important marine mammal species). Such trophic relationships provide relatively direct links from the sediments, which are the major repository for the potentially pollutant chemicals, to man. Marine bacteria, colonizing on the sediments and in interstial water, provide substantial nutrition for deposit feeders e.g., Macoma balthica and chemical recycling for inorganic and organic compounds. The uptake of one highly toxic metal (cadmium) by a marine heterotrophic bacterial population was found to exceed a concentration factor of 10,000. The bacteria in this situation seem to be an important mechanism for the bio-accumulation of cadmium in sediments and in organisms linked to the bacteria-sediment food chain. When cadmium-enriched bacteria were used as the sole food for the deposit feeding clam M. balthica (common to Alaskan intertidal environments), the clams also showed enrichment of the metal over the controls. The transfer efficiency in this aquaria ingestion experiment was close to one and depuration appeared to be relatively rapid. The significance of these data to the fisheries and potential pollution in Alaskan waters is discussed. (Sinha-OEIS)
W80-03897

SOURCES AND CHARACTERISTICS OF LIQUID PROCESS WASTES FROM ARCTIC OFFSHORE HYDROCARBON EXPLORATION,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Arctic, Vol 32, No 1, p 3-21, March 1979. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Water pollution, *Arctic, *Exploration, *Liquid wastes, Resources development, Environmental effects, Monitoring, Drilling fluids, Oil pollution, *Outer Continental Shelf, Hydrocarbons.

Increased interest in offshore hydrocarbon exploration in Arctic waters raises concern regarding liquid waste management from drilling operations. The typical sources of process liquid waste from exploratory drilling operations is described and data on the quantity and quality of liquid waste discharges is provided from monitoring at two offshore sites. The chemical and toxicological characteristics of the waste fluids indicate that a potential exists for water pollution in specific circumstances. However, close process control to reduce the quantities of waste fluid generated and judicious selection of drilling mud additives should prevent the occurence of significant water pollution problems from waste fluid disposal at exploratory Arctic offshore drilling operations. (Sinha-OEIS)
W80-03898

INCORPORATION, DISTRIBUTION AND FATE OF SATURATED PETROLEUM HYDROCARBONS IN SEDIMENTS FROM A CONTROLLED MARINE ECOSYSTEM,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
T. L. Wade, and J. G. Quinn.
Marine Environmental Research, Vol 3, No 1, p 15-33, January-March 1980. 5 Fig, 5 Tab, 27 Ref.

Descriptors: *Oil pollution, *Sediments, *Estuaries, *Ecosystems, Baseline studies, Water pollution effects, Environmental effects, *Outer Continental Shelf, Petroleum hydrocarbons.

A simulation of a chronic input of petroleum into an estuarine environment was investigated using the facilities at the Marine Ecosystems Research Laboratory at the University of Rhode Island. An oil-water dispersion of No. 2 fuel oil was added to the system (twice weekly for 24 weeks) and the saturated hydrocarbons from this oil were measured in suspended material and sediments. After the initial chronic oil addition, trace amounts of hydrocarbons were detected in the sediments within two weeks, but substantial accumulation was not detected for approximately 135 days. The oil appeared to enter the sediment via the suspended material, with most of the saturated hydrocarbons associated with smaller size sediment particles. With time, the fuel oil saturated hydrocarbons in the sediments were mixed to a depth of 3 to 4 cm. Although only 12% of the total saturated hydrocarbons added to the system were found in the sediments, these hydrocarbons appear to be relatively stable and were still detectable in these sediments for at least six months after the last oil addition. (Sinha-OEIS)
W80-03899

STEROLS IN NATURAL WATER AND SEDIMENT,
Texas University at Dallas, Richardson. Center for Environmental Studies.
J. P. Hassett, Jr., and G. F. Lee.
Water Research, Vol 11, No 11, p 983-989, 1977. 5 Fig, 3 Tab, 24 Ref. EPA 5T2-WP.

Descriptors: *Organic compounds, *Lake Mendota(WI), *Torch Lake(MI), *Sediments, *Water chemistry, *Lake Wingra(WI), Water analysis, Gas chromatography, Chemical reactions, Biochemistry, Sewage effluents, Organic matter, Water pollution sources, Sewage, Sewage disposal, Sedimentation, Chemistry, Runoff, Wisconsin, Michigan.

C-27, C-28 and C-29 sterols were present in sediments of lakes Mendota and Wingra, Wisconsin, and Torch Lake, Michigan, January and May, 1973. In Lake Mendota sediments, both saturated and unsaturated sterols were present, but this distinction was not made for lakes Wingra and Torch sediments. Saturated sterols indicate that sterols are being reduced; since the degree of saturation is greater in free sterols than in sterol esters, ester hydrolysis may occur more rapidly than reduction of double bonds. In Lake Mendota sediments, ester sterols account for 10% of total sterol content. Fecal sterol coprostanol is present in all samples, indicating that organic compounds from sewage are accumulating in these sediments. Sterol concentrations in Lakes Mendota and Torch water are 1000 times less than dry weight concentrations in Torch Lake sediments; therefore, sterols are accumulating in sediments. Sterol concentrations are 0.8 micro g cholestrol/l and 3 micro g beta-sitosterol/l in Lake Mindota water and 0.7 micro g cholestrol/l and 2 micro g beta-sitosterol/l in Torch Lake water. Minimum concentration in Torch Lake sediment is 3 ppm sterols on a dry weight basis. Exact identity and origin of sterols in these lakes is unknown. Algae and terrestrial runoff probably contribute most sterols; however, it is not known which source is more important. Torch Lake has received large amounts of copper mine tailings and is receiving sewage effluent. Lakes Wingra and Mendota both receive storm water drainage; Lake Mendota also receives agricultural drainage. (Danovich-Wisconsin)
W80-03900

5D. Waste Treatment Processes

NITRIFICATION-DENITRIFICATION OF WASTEWATER,
Union Carbide Corp., NY. (Assignee).
L. C. Matsch, and R. F. Drnevich.
U.S. Patent No 4,173,531, 15 p, 6 Fig, 6 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 175, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Sewage treatment, Activated sludge, Oxygenation, Nitrification, Denitrification, Bacteria.

This invention is practiced in the activated sludge-type system in which wastewater containing nitrogenous compounds is mixed in an oxidation zone in the presence of carbonaceous compounds with oxygen-containing gas and activated sludge containing carbon-consuming and nitrogen-oxidizing bacteria for sufficient duration to nitrify the nitrogenous compounds and form nitrified oxygenated mixed liquor which is discharged from the oxidation zone and passed to a separate zone to effect concentration of solids from liquor with at least a major part of the concentrated solids being returned to the oxidation zone as activated sludge such that the total residence time of solids (SRT) is at least two days. More specifically nitrified oxygenated liquid-solid is withdrawn to a zone in which the dissolved oxygen concentration in the liquid or liquor is below about 0.3 mg/l and preferably below about 0.2 mg/l such that nitrate and nitrate compounds are reduced to gases such as elemental nitrogen and nitrous oxide by heterotrophic denitrifying bacteria. (Sinha-OEIS)
W80-03610

METHOD FOR REMOVING SUSPENDED OIL DROPLETS FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
R. E. Williams.
U.S. Patent No 4,173,533, 6 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 176, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, *Separation techniques, Bubbles, Oily water, Oil wastes, Offshore platforms, Equipment, Coalescence.

Suspended droplets of oil are separated from a waste water stream by the method and apparatus of this invention. The oil and water mixture is injected into a partially submerged, vertical pipe. Gas bubbles injected into the lower end of the pipe, rise through the pipe and counter-currently contact the suspended oil droplets, thereby promoting the separation of the droplets from the waste water. The oil droplets coalesce and form a separate oil layer on top of the waste water which is readily withdrawn while clarified waste water is discharged from the lower end of the pipe. If employed to separate oil from a waste water stream on an offshore rig, the vertical pipe is submerged adjacent to the rig. (Sinha-OEIS)
W80-03647

DISINFECTION/TREATMENT OF COMBINED SEWER OVERFLOWS, SYRACUSE, NEW YORK,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
F. J. Drehwing, A. J. Oliver, D. A. MacArthur, and P. E. Moffa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113459, Price codes: A12 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-134, August 1979. 260 p, 95 Fig, 64 Tab, 107 Ref, 7 Append. S802400(11020HFR).

Descriptors: *Combined sewers, *Storm runoff, *Waste water treatment, *Disinfection, Chlorination, Screens, Regression analysis, Mathematical models, Sewers, Sewage bacteria, Suspended solids, New York, Cost analysis, Operating costs, Water pollution sources, *Syracuse(NY).

The treatment of combined sewer overflows (CSO) at the point of overflow with the use of high-rate treatment techniques was studied at the Onondaga County Department of Drainage and Sanitation in Syracuse, New York. The high-rate techniques tested included three fine-mesh microscreening devices, and a swirl regulator/concentrator followed by disinfection by chlorine (C12) and chlorine dioxide (C102). During 1974 through 1976, 16 overflow events were monitored for the screening devices and 11 events were monitored for the swirl unit. The three microscreening units were a Sweco Wastewater Concentrator, a Zurn Micromatic, and a Crane Microstrainer with screen aperatures of 105 microns, 71 microns, and

3 microns respectively. Multiple regression analys was used to develop mathematical performance odels for the three screening devices and for the wirl regulator/concentrator relating suspended olids (SS) removal to influent hydraulic loading nd influent SS concentrations. Statistically signifiant performance equations were developed for he C12 and C102 disinfection systems using multile regression modeling. Results show that applicaion of high-rate disinfection processes can result in ignificant reduction of bacterial concentrations in SO. Also, the removal of SS improved this reuction of bacteria concentrations with the improvement being slightly more pronounced for C102 than for C12 disinfection. C12 disinfection, owever, has the lower capital and operating osts. Special situation studies are also reported on irus inactivation, bench-scale ultraviolet light disnfection, on-line monitoring of SS, continuous monitoring of total organic carbon and chlorinated ydrocarbon analyses. (Seigler-IPA)
W80-03651

SCREENING/FLOTATION TREATMENT OF COMBINED SEWER OVERFLOWS, VOLUME II: FULL-SCALE OPERATION RACINE, WISCONSIN,
Envirex Inc., Milwaukee, WI. Environmental Sciences Div.
T. L. Meinholz, D. A. Gruber, R. A. Race, C. A. Hansen, and J. H. Moser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-130693, Price codes: A17 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-106a, August 1979. 374 p, 130 Fig, 120 Tab, 11 Ref. S800744.

Descriptors: *Combined sewers, *Storm drains, *Waste water treatment, *Storm runoff, Water pollution sources, Mathematical models, Overflow, Dissolved oxygen, Biochemical oxygen demand, Wisconsin, Coliforms, Phosphorus, Flotation, Screening, *Racine(Wis).

Three full-scale demonstration 'satellite plants' for combined sewer overflow treatment were planned, designed, constructed, operated, and monitored over a two-year period to evaluate their effectiveness as alternatives to combines sewer separation. The plants are located in Racine, Wisconsin, at major points of combined sewer overflow to the Root River. Two of the 'satellite plants' use screening/dissolved-air flotation treatment prior to overflow discharge and have a combined capacity of 22,000 cu m/day. The third plant with a capacity of 14,800 cu m/day used only screening. Permanent automatic samplers were used to collect samples of influent, screened effluent, and final effluent. These samples were analyzed for dissolved and total biochemical oxygen demand (BOD); dissolved and total organic a carbon; total, suspended (SS), and suspended volatile solids; total phosphorus; fecal coliforms; pH; and chlorine residual. Specific runs were analyzed for pesticides, particle size, the nitrogen series, chloride, and fecal streptococci. Results show that the 'satellite plants' are feasible alternatives to sewer separation. Removal efficiencies of 60 to 75% were recorded for SS and 50 to 65% for BOD. The screening method removed 50% SS and 20% BOD. Operation of the systems had a beneficial effect on the receiving waters of the Root River. Data from this area and study were also used to verify and modify the Storm Water Management Model. (Seigler-IPA)
W80-03652

COMPARISON OF OZONE CONTACTORS FOR MUNICIPAL WASTEWATER EFFLUENT DISINFECTION -- PACKED COLUMN VERSUS JET SCRUBBER,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
A. D. Venosa, E. J. Opatken, and M. C. Meckes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118789, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-098, August 1979. 92 p, 24 Fig, 40 Tab, 19 Ref, 3 Append.

Descriptors: *Ozone, *Disinfection, *Waste water treatment, Coliforms, Biochemical oxygen demand, Turbidity, Ammonia, Nitrogen compounds, Regression analysis, Suspended solids, Organic wastes, Effluents, Sewage effluents, Chlorination, Aquatic microorganisms.

The engineering and microbial parameters affecting waste water disinfection by ozonation were studied for two types of ozone contactors. The contactors tested, a jet scrubber and a packed column, were compared for ozone utilization and coliform reduction efficiency. Each contactor had a nominal design flow capacity of 75 1/min of secondary effluent. Three operation phases were used: (1) batch operation -- both contactors operated separately under identical conditions, (2) parallel operation -- both contactors operated in parallel on the same effluent, and (3) continuous operation -- both contactors operated in parallel for a three log reduction of coliforms in the same effluent. Samples were collected both before and after ozonation and were analyzed for total and fecal coliforms, temperature, chemical oxygen demand, turbidity, total organic carbon, suspended solids, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, pH, total Kjeldahl nitrogen, and others. Ozone residual was determined by amperometric techniques. Regression analysis was used to determine which factors in the effluent contributed to variations in microorganism reduction and mass transfer efficiency. Results show that a jet scrubber type contactor is not efficient for ozone disinfection primarily due to the lack of sufficient residual levels produced. The performance of both contactors was dependent on waste water effluent quality with chemical oxygen demand and organic carbon as major controlling factors. The packed column was superior to the jet scrubber in ozone utilization with the difference increasing with increasing ozone dosage. (Seigler-IPA)
W80-03653

COMBINED SEWER OVERFLOW TREATMENT BY SCREENING AND TERMINAL PONDING -- FORT WAYNE, INDIANA,
Howard, Needles, Tammen, and Bergendoff. Indianapolis, IN.
D. H. Prah, and P. L. Brunner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-11939, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-085, August 1979. 137 p, 54 Fig, 30 Tab, 5 Ref. 11020 GYU.

Descriptors: *Combined sewers, *Overflow, *Ponding, *Storm drains, *Screens, Storm water, Sewers, Sewage treatment, Sewage lagoons, Water quality, Chlorination, Water pollution, Nutrients, Chemical oxygen demand, Costs analysis, Biochemical oxygen demand, Coliforms, Indiana, Fort Wayne(Ind).

The Fort Wayne Stormwater Treatment Evaluation Project, a 75 MGD plant, was constructed in 1973-74 to study the effectiveness and costs of screening combined sewer overflows (CSO). Three types of screening techniques were tested: fixed side hill vertical screens, rotary centrifugal fine screening, and horizontal rotary drum fine screening. The benefits to receiving water by the pollutant removal effects of these screening techniques were quantified. Thirty-eight stormwater treatment events were studied. Grab samples were taken and analyzed for 14 water quality parameters including pH, temperature, settleable solids, and fecal coliforms. Results show that at the 95% confidence level, removal efficiencies for suspended solids, five-bay biochemical oxygen demand, chemical oxygen demand, and nutrients were not significantly different from zero for the screening methods tested. Also, no relationship between removal efficiency and hydraulic loading was observed. The fixed vertical-type screen had the least overall cost at $25.25/MG. Hydraulic head requirements for all screens were in the order of 2 to 10 feet static loss. A 32-acre terminal pond was capable of meeting secondary effluent standards 95% of the time even with the addition of storm-caused combined sewer overflows. Overall the treatment plant reduced the bypassing of raw untreated CSO by 82% which resulted in improvements in quality of the receiving waters. (Seigler-IPA)
W80-03656

LEVEL III: RECEIVING WATER QUALITY MODELING FOR URBAN STORMWATER MANAGEMENT,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
M. A. Medina.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134406, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-100, August 1979. 215 p, 30 Fig, 17 Tab, 39 Ref, 2 Append.

Descriptors: *Mathematical models, *Combined sewers, *Urban runoff, *Waste water treatment, Water pollution sources, Hydrologic aspects, Computer models, Computer programs, Iowa, Dissolved oxygen, Sewage treatment, Runoff, Surface runoff, Rainfall-runoff relationships.

The development, operation, and application of a simplified continuous receiving water quality model, Level III-Receiving, are described. The model is designed to permit preliminary planning and screening of areawide urban waste water treatment alternatives for the major parameters of frequency of water quality violations and dissolved oxygen concentrations. The model can simulate the response of a stream or tidal system to the effects of waste input from upstream sources, dry weather urban sources, and wet weather urban sources. These simulations can be made for inputs from separate or combined sources. By identifying a minimum interevent time the total hours of runoff in a year are divided into storm events. Dissolved oxygen concentrations are estimated as a function of hydrodynamic and biochemical parameters. The model can be interfaced with the Hydrologic Engineering Center model, STORM, and with the continuous version of the Storm Water Management Model (SWMM). The model is not applicable to systems requiring multidimensional transient analysis and complex conditions such as eutrophication and sedimentation are not accounted for. The model was applied to the Des Moines River at Des Moines, Iowa, and results are given. Also included are STORM input data and load module job control language and a program listing. (Seigler-IPA)
W80-03657

THE DISTRIBUTION AND ECOLOGY OF THE NAIDIDAE (OLIGOCHAETA) WHICH INHABIT THE FILTER-BEDS OF SEWAGE-WORKS IN BRITAIN,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W80-03666

CHARACTERISTICS OF EFFLUENTS FROM GRAY AND BLACK WATER SEPTIC TANKS,
Ontario Ministry of the Environment, Ottawa.
For primary bibliographic entry see Field 5B.
W80-03791

THE EFFECT OF PHOSPHATE AND TEMPERATURE ON GROWTH OF ACTIVATED SLUDGE AND ON BIODEGRADATION OF SURFACTANTS,
Water Pollution Research Lab., Stevenage (England).
H. A. Painter, and E. F. King.
Water Research, Vol 12, No 11, p 909-915, 1978, 2 Fig, 5 Tab, 10 Ref.

Descriptors: *Temperature, *Surfactants, *Activated sludge, *Phosphorus, *Waste water treatment, *Sewage sludge, *Peptone, Phosphates, Biodegradation, Sewage, Water treatment, Sludge treatment, Lime, Sludge, Growth rates, Sewage treatment, Testing procedures, Chemical oxygen demand, Biochemical oxygen demand, Flocculation, Sewage bacteria, Bacteria.

Peptone phosphorus content variability causes most poor growth rates of non-flocculent sludge, leading to erratic and falsely low removal degrees of both chemical oxygen demand (COD) and added surfactants. Adequate phosphorus must be present in OECD/EEC synthetic sewage for proper qualitative and quantitative sludge growth and valid measurements of added surfactant removal. Phosphorus concentrations must be 2-5 mg/l in the sewage with 230-300 mg/l COD, 150-200 mg/l BOD and 98-136 mg/l TOC. Lack of phosphate also causes trouble in both units; because sludge grows in a dispersed, non-flocculent form which frequently blocks pores in WRC units, settles poorly, and causes solid losses in Husmann units. Generally, phosphorus-deficient sludges posses few bacteria types, very few attached ciliated protozoa, and no crawling ciliates. Of synthetic sewage constitutents, only peptone and meat extracts are likely to contain sufficient phosphorus to supply nutrient needs of sludge microorganisms. Addition of 5 mg P/l is recommended to ensure against phosphorus deficiency. Concentrations of 8 mg P/l give results significantly similar to those obtained with 2-3 mg P/l. Low temperatures (10C) do not affect normal sludge growth or floc formulation; the over riding factor is adequate phosphorus. Similarly, removal degrees of alkylbenzene sulphonates JNQ and TBS, and of alcohol ethoxylate, are only slightly depressed at 10C compared with those at 20C: larger effects are observed at both temperatures while phosphorus is limited. (Danovich-Wisconsin)
W80-03793

ALGAE GROWN ON WASTEWATER AS A SOURCE OF PROTEIN FOR YOUNG CHICKENS AND RATS,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03817

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03818

WILL JUDICIAL ERROR ALLOW INDUSTRIAL POINT SOURCES TO AVOID BPT AND PERHAPS BAT LATER. A STORY OF GOOD INTENTIONS, BAD DICTUM, AND UGLY CONSEQUENCES,
Weston, Hurd, Fallon, Paisley, and Howley, Cleveland, OH.
For primary bibliographic entry see Field 6E.
W80-03885

5F. Water Treatment and Quality Alteration

EFFECT OF PARTICULATES ON OZONE DISINFECTION OF BACTERIA AND VIRUSES IN WATER,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
O. J. Sproul, C. E. Buck, M. A. Emerson, D. Boyce, and D. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116825, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-089, August 1979. 85 p, 7 Fig, 29 Tab, 39 Ref. R-804587.

Descriptors: *Ozone, *Water treatment, *Disinfection, *Water purification, Enteric bacteria, E. coli, Viruses, Microbiology, Turbidity, Particle size, Bentonite, Water pollution, Flocculation, Environmental engineering, Potable water.

Enteric bacteria and viruses adsorbed or incorporated into fecal material, HEp-2 cells, aluminum oxide floc and bentonite clay were subjected to ozone disinfection to determine the effect of particulates on disinfection efficiency. The organisms tested were fecal coliforms, poliovirus (Sabin Type 1), Coxsackievirus A9, porcine picornavirus type 3 (Strain ECPO-6), and f(2) bacteriophage. Particulates were tested at concentrations of 1 or 5 Nephelometric Turbidity Units. Results show that some of the test organisms were protected to differing degrees by the particulates and that the normal ozone disinfection procedures used for free organisms were not sufficient. Cell-associated poliovirus and Coxsackievirus were most protected by HEp-2 cells. Concentrations of 5.33 to 4.81 mg/l ozone were required to inactivate the cell-associated Coxsackievirus in 5 to 0 minutes. Escherichia coli, poliovirus and Coxsackievirus associated with hydrated aluminum oxide floc and bentonite clay showed little or no increased resistance to disinfection. The f(2) bacteriophage was somewhat protected by bentonite clay particles. A continuous flow disinfection apparatus was used for the tests with a bath reactor for continuous ozonation. Ozone concentrations were measured according to a slightly modified method of Schechter. (Seigler-IPA)
W80-03654

ESTIMATING WATER TREATMENT COSTS, VOLUME 4. COMPUTER USER'S MANUAL FOR RETRIEVING AND UPDATING COST DATA,
Culp/Wesner/Culp, Santa Ana, CA.
T. S. Lineck, R. C. Gumerman, and R. L. Culp.
Environmental Protection Technology Series Report No EPA-600/2-79-162d, August 1979. 86 p, 3 Fig, 6 Tab. 68-03-2516.

Descriptors: *Computer programs, *Economic analysis, *Water treatment, *Cost analysis, *Data storage and retrieval, Water supply, Construction costs, Cost comparisons, Administrative costs, Maintenance costs, Operating costs, Unit costs, Treatment facilities.

Documentation and user information for the FORTRAN computer program WATER is given. The program is designed to retrieve and update cost information for 72 large and 27 small supply systems that were previously studied to determine their construction, operation, and maintenance costs. Cost curves developed from the study are used in WATER. The program facilitates the estimation of overall treatment plant costs as well as individual process costs. Costs determined for treatment plants are input as trains of individual processes. Costs are determined by retrieving stored coefficients for a least squares polynomial fit of the cost curves and by evaluating this for the selected process design parameters. Construction costs are in terms of October 1978 dollars and can be updated by the user by two methods. A weighted composite cost index can be computed for each process or updating can be done by use of the Engineering Record Construction Cost Index. Capital costs can be determined from construction costs by applying cost factors. General contractor overhead and profit, legal, fiscal, and administrative fees, and interest can also be generated. Three data files are needed to run the program, two set up by the user and a third contained in the manual. Examples of the two user input files are given. Other information given includes program output, examples, a trouble shooting guide, and a WATER Program listing. (Seigler-IPA)
W80-03655

MANGANESE REMOVAL FROM WATER BY FLOTATION WITH MICROGAS DISPERSIONS,
Rhode Island Univ., Kingston.
F. J. DeLuise.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153117, Price codes: A02 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island Completion Report (1979) 18 p, 7 Fig, 1 Tab, 11 Ref. OWRT A-067-RI (1), 14-34-0001-9042.

Descriptors: *Manganese, *Flotation, *Surfactants, *Water treatment, Methodology, Hydrogen ion concentration, *Manganese removal, Water supply.

Microgas dispersions have been used in precipitate flotation to remove manganese from dilute aqueous solutions. Various surfactants were employed in both batch and continuous operating processes, with anionic surfactants, particularly DBSS, proving the most effective for manganese removal. Final concentrations of 0.06 mg/l have been achieved consistently in the continuous countercurrent process. The effects of pH, MGD dispersion rate, and solution flow rate are presented.
W80-03748

NITROGEN FIXATION BY THERMOPHILIC BLUE-GREEN ALGAE (CYANOBACTERIA): TEMPERATURE CHARACTERISTICS AND POTENTIAL USE IN BIOPHOTOLYSIS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
K. Miyamoto, P. C. Hallenbeck, and J. R. Benemann.
Applied and Environmental Microbiology, Vol 37, No 3, p 454-458, March, 1979. 8 Fig, 1 Tab, 15 Ref.

Descriptors: *Nitrogen fixation, *Temperature, *Nitrogen fixing bacteria, *Biophotolysis, Algae, Nitrogen, Bacteria, Cyanophyta, Light intensity, Oxygen, Growth rates, Animal physiology, Microorganisms, Laboratory tests, Cultures, Hydrogen, Solar energy.

Mastigocladus Laminosus NZ-86-m, thermophilic, nitrogen-fixing blue-green algae potentially useful for practical biophotolysis application, grows well in 35-50C temperature range and exhibits high acetylene reduction activity comparable to that of Anabaena species. Three M. laminosus strains were grown in modified Allen and Arnon medium. Among the strains tested, NZ-86-m showed higher specific activity; all three were similar in temperature dependency of nitrogenase activity. NZ-86-m fixes nitrogen at temperatures up to 54C with optimum nitrogen fixation occurring at 45C. Atmospheric oxygen tension is slightly inhibitory (about 20%) to this algae regardless of growth rates. A light intensity of 10,000 ergs/sq cm s is saturating. Continuous culture for two months can occur without significant contamination problems. At an increased light intensity (30,000 ergs/sq cm s), strain NZ-86-m grows exponentially to 150 Klett units before reaching light-limited, linear growth. When sparged gas is switched from air-C02 to various argon-N2-C02 mixtures, peak hydrogen evolution rates are observed. These rates are roughly proportional to algal cell density when exponentially growing cells are used. Light energy to hydrogen gas conversion efficiency is 2.7% at the highest production rate. (Danovich-Wisconsin)
W80-03796

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
For primary bibliographic entry see Field 6E.
W80-03857

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
A. Daorai, and R. E. Menzer.
Archives of Environmental Contamination and Toxicology, Vol 5, No 2, p 229-240, 1977. 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Water pollution, *Insecticides, *Pesticide toxicity, *Mosquitoes, Laboratory tests, Microorganisms, Toxicity, Radioactivity, Metabolism, Pesticide residues, Biodegradation, Degradation(Decomposition), Larvae, Larval growth stage, Chemical degradation, Path of pollutants, Organic matter, Denton(MD), Wye Mills(MD), Maryland.

Abate, an insecticide used to control mosquito larvae, seems less effective in polluted water and higher application rates are needed to control mosquito larvae. While some hydrolytic and oxidative degradation takes place, most Abate addaded to mosquito ponds is adsorbed by organic matter and then slowly released into the pond over longer

time periods. This investigation was undertaken to observe Abate metabolism by some microorganisms. Two sources of water were used: (1) A Denton, Maryland, sewage treatment plant, and (2) a spring-fed farm pond near Wye Mills, Maryland. Greater radioactivity occurred after extraction in the Denton sewage sample, which might indicate hydrolic metabolism. However, differences are probably due to effects of organic materials on Abate's solubility and extractability rather than to effects on its metabolism. Microorganisms isolated from polluted water are able to degrade Abate to a small degree. The selective isolate, Pseudomonas sp, breaks down Abate into water-soluble compounds and converts Abate into highly polar metabolites. However, amounts of degradation or metabolites produced are not sufficient to explain Abate's reduced effectiveness under these conditions, rather Abate has an apparent affinity for organic matter. This affinity is helpful in explaining mosquito larvae toxicity at very low concentrations. If Abate concentrates on mosquito larvae or on microorganisms which are fed upon by larvae, then the effective concentration near larvae is very high. (Danovich-Wisconsin)
W80-03892

5G. Water Quality Control

RIVER-QUALITY ASSESSMENTS.
For primary bibliographic entry see Field 5B.
W80-03606

RIVER-QUALITY ASSESSMENT--A RATIONAL SCIENTIFIC BASIS FOR POLLUTION CONTROL AND WATER-QUALITY MANAGEMENT,
C. J. Velz.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 3-10, 1978. 5 Ref.

Descriptors: *Water quality, *Water management(Applied), *Water pollution control, *River basins, Water treatment, Streams, Low-flow augmentation, Self-purification, Droughts, Tertiary treatment, Waste water treatment, Legislation, Federal Water Pollution Control Act, River-quality assessment.

Achievement of desirable river quality at acceptable costs requires that management decisions be based on sound impact assessments in each basin, not on arbitrary decisions applied on a blanket national scale. Major aspects considered in the paper are: why the Geological Survey undertook River-Quality Assessments (RQA); definition of rational RQA and other concepts; consideration of viable alternative strategies in water-quality management; and discussion of contrasts between rational-scientific approach and the current arbitrary-legalistic procedure under P.L. 92-500. Rational RQA is problem oriented. Each river basin has its unique problems and solutions, depending upon its hydrologic setting and man's use of the resources. The distinguishing element of rational RQA is that, since true cause-effect relationships are defined and verified from intensive investigations and synoptic river sampling, a scientific basis is provided for evaluating impacts on river quality by which various plans of action can be judged. In considering strategies, emphasis is given to all viable alternatives, including stream self-purification, low streamflow augmentation, and the limitations of wastewater treatment. In contrast, P.L. 92-500 is dominantly federalistic, legalistic, and arbitrary. Congress overreacted to Executive Branch abuses and to explosive pressures from new ecology groups. Basic changes in the law are in order. (See also W80-03606) (Humphreys-ISWS)
W80-03607

ON THE VALUE OF SOIL COLUMNS FOR ASSESSING THE TRANSPORT PATTERN OF VIRUSES THROUGH SOILS: A CRITICAL OUTLOOK,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W80-03622

CONTRIBUTIONS OF URBAN LAND USE TO STREAM WATER QUALITY,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-03644

METHOD FOR REMOVING SUSPENDED OIL DROPLETS FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
For primary bibliographic entry see Field 5D.
W80-03647

LEVEL III: RECEIVING WATER QUALITY MODELING FOR URBAN STORMWATER MANAGEMENT,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-03657

LIABILITY FOR OIL POLLUTION - UNITED STATES LAW,
Glassie, Pewett, Beebe and Shanks, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-03667

A REVIEW OF NEW COLORADO WATER AND AIR POLLUTION LEGISLATION,
For primary bibliographic entry see Field 6E.
W80-03668

DETERMINANTS OF WATER QUALITY IN AGRICULTURAL WATERSHEDS,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution.
I. J. Schlosser, and J. R. Karr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153604, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 147. January, 1980. 81 p, 29 Fig, 1 Tab, 39 Ref, 3 Append. OWRT A-093-ILL(1).

Descriptors: *Agricultural watersheds, *Channel morphology, *Nonpoint pollution, *Riparian plants, *Suspended solids, Illinois, *Water quality, Phosphorus streams, Turbidity, Model studies, Rainfall-runoff relationships.

Water quality was monitored for 17 months in six different agricultural watersheds in east central Illinois to evaluate the impact of alterations in riparian vegetation and channel morphology. Sampling was conducted during both base flow and runoff periods. The results indicate that the relevant theory for enhancement of water resources and for modelling water quality in agricultural watersheds varies depending on flow conditions. During base flow, emphasis should be placed on linking hydrological theory of instream transport of inorganic material to biological theory of production and transport of organic material. Peak levels of all parameters are reached during the summer period of increased biotic activity. Concentrations of suspended solids remain relatively constant, and seasonal dynamics of phosphorus and turbidity appear to be controlled by leaf inputs in fall. During runoff events, a simple model based on the KLS factors of the Universal Soil Loss Equation accurately predicts spatial patterns of suspended solids, turbidity, and phophorus levels in watersheds with a uniform channelized stream well protected stream banks, and cultivation to the stream edge. The model was not an accurate predictor where heterogeneity in riparian vegetation and channel morphology existed. Suspended solids concentrations were greater than predicted in areas where unstable (fine) substates occur and potential energy of the stream is high due to removal of riparian vegetation and creation of a uniform and straight channel.
W80-03709

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
For primary bibliographic entry see Field 5F.
W80-03892

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE ANTICIPATED DECISION INFLUENCE PERIOD IN REAL TIME RESERVOIR OPERATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
L. A. W. Anderberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151301, Price codes: A04 in paper copy, A01 in microfiche. PhD Dissertation, 1979. 50 p, 9 Fig, 13 Ref. OWRT B-195-COLO(1), 14-34-0001-9060.

Descriptors: *Reservoir operation model, *Reservoir release decisions, Reservoir release policy, *Reservoir storage, Reservoir yield, Optimum hydropower production, Power production, Hydroelectric power, Water supply, *Reservoir operation, Decision making.

A reservoir is a physical mechanism that provides a potential to turn an unreliable source of water into a dependable water supply system. A set of rules and the reservoir operator's skill and experience are supposed to utilize the potential of the reservoir such that the predetermined objectives of the sytem are carried out in the most beneficial way. The rules for operation should ideally trade off immediate benefits against future benefits to be expected such that both the needed assurance of water and/or power is provided for and the potential of the reservoir is utilized most efficiently. Present practice in reservoir operation provides the assurance implicitly by means of the Critical Period, but has no explicit mechanism to improve the efficiency of operation. In order to be able to employ a mechanism to trade off immediate benefits against expected future benefits, a time frame over which the total benefits intermediate decisions and their associated risks can be explicitly evaluated has to be recognized. This dissertation presents a logic for such a time frame, called the Anticipated Decision Influence Period, ADIP. Within this context an analysis and discussing of responsive and flexible reservoir operation rules to guide the operator in the decision-making process. It is suggested that currently used Rules Curves can be favorably substituted by Operational Equations in order to enhance flexibility.
W80-03645

AN INTERACTIVE RIVER BASIN WATER MANAGEMENT MODEL: SYNTHESIS AND APPLICATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. M. Shafer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153547, Price codes: A10 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Technical Report No 18, August 1979. 246 p, 42 Fig, 36 Tab, 58 Ref, 5 Append. OWRT A-039-COLO(3), 14-34-0001-8006.

Descriptors: *Simulation, *Water supply, River basins, Network analysis, *Interbasin water transfers, Streamflow, Reservoir storage, Water management, Water conveyance, Computers models, Model studies, Gache la Poudre River.

A computer model is presented for quantifying the impacts of multipurpose water management policy. the model is designed for the analysis of water availabilities throughout a river basin over extended time periods. It is capable of simulating the monthly storage, flow, and diversion of water in a

complex river basin system. The prototype system is represented in the model by a network of interconnected nodes which characterize the reservoirs, tributary inflow points, and diversion points in the basin. Linkages between nodes represent the conveyance morphology of the basin. The model, MODSIM, is synthesized from previously existing models. A base or core model is selected from these models, and further modified so as to better conform to the attributes and capabilities considered desirable for the model. An advantage of the model is its optimizing capability with respect to reservoir operating rules. Also, MODSIM is able to simulate institutional dictates governing water allocation, such as water rights priorities. Conveyance losses and return flows resulting from irrigation practices can also be considered by MODSIM. MODSIM is interfaced with an interactive conversational data management package. Conversational programming facilitates the rapid analysis of management alternatives, and promotes the successful transfer of this technology to water planners and managers with little background in computer programming. Two case studies are presented which demonstrate the utility of MODSIM for aiding in the analysis of impacts of long-term changes in water resource management within a river basin. The Cache la Poudre River Basin in north-central Colorado is used for both case studies.
W80-03708

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. K. Boling, M. C. Carpenter, and S. N. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151434, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Project Partial Completion Report, January 1980. 43 p, 11 Fig, 46 Ref, 3 Append. OWRT A-073-ARIZ(2), 14-34-0001-7005, 7006 & 8003.

Descriptors: *Fissures(Geologic), *Land subsidence, Movement, Forecasting, *Arizona, Structural geology, Pumping, Groundwater, Drawdown, Measurement, Dial gauges, Signal peak(Ariz), Picacho Mountains(Ariz), Avra Valley(Ariz).

Bimonthly horizontal strain measurements of fissures have been made at 7 dial gages near Signal Peak, Picacho Mountains, and in Avra Valley, AZ. A Pyrex glass rod is fixed on one side of a fissure and pushes against a dial gauge fixed to the other side. Installations are in shallow covered trenches. Movements ranging from 5 mm to 25 mm are detected with a measurement error of less than 5 mm. Fissures have been observed to open and close repeatedly. With one exception, old and new cracks showed no pronounced difference in character. The max. opening rate was 4.1 mm hr-1 over a 17-day period, and the max. closing rate was 5.0 mm hr-1 over a 14-day period. Following a severe storm, one fissure abruptly opened 31 mm within a 14-hour period while one nearby parallel fissure opened 1.6 mm and another nearby parallel fissure closed 2.1 mm. Transducer measurements of horizontal movements across fissures of up to 4 hours' duration were made with a resolution of 10 nm. Simultaneous measurements of horizontal linear strain in nearby unfissured soils provided controls. In Avra Valley, the greatest rate of fissure closing was 8.7 um hr-1 across a span of 95 cm, while the control installation exhibited a compressive strain rate of 2.3 x10-6 hr-1. The greatest rate of fissure opening was 3.8 um hr-1 over an 86 cm span while the control dilated 0.43 x 10-6 hr-1. At a breached section of McMicken Dam, the greatest opening and closing rates were 6.0 um hr-1 and 10 um hr-1 over a 76 cm span. At both locations, the fissure movement and control strain were mostly in the same sense and the movement was smooth. Correlation of fissure movement, rainfall, pumping and water level fluctuations indicates major earth fissure movements will occur after high pumping rates during or shortly after large storms. Long term records will form the data base for predictive models of subsidence and earth fissuring.
W80-03710

STANDARDS, OPTIMALITY AND RESILIENCE IN WATER-RESOURCE MANAGEMENT,
Harvard Univ., Cambridge. Div. of Applied Sciences.
M. B. Fiering, J. J. Harrington, and P. P. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153240, Price codes: A25 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December 1978. 491 p, 73 Fig, 68 Tab, 129 Ref, 1 Append. OWRT C-7095 (No 6208)(2), 14-34-0001-6208.

Descriptors: *Water resources development, *Planning, *Investment, *Institutions, *Probability, Reservoirs, Economics, Water quality control, Flood control, Political aspects, Water supply, Flood frequency, Resilience, Robust statistics, Technological uncertainty, Optimal design, Model complexity, Institutions, Nearly optimal decisions, Connecticut River.

Three parallel threads are studied. One introduces system resilience into assessment of water-resource projects. It takes specific account of the time - dependent response of water-resource systems to major changes in supply, demand and extreme events. The notions of time-to-failure and time-between-failures are introduced. A new density function, the Wakeby, is introduced for flood frequency analysis; it is shown to have important properties of robustness. A calculus for decision-making under uncertain technology is shown to lead to resilient decisions. The second thread emphasizes institutional resilience by noting that problems have an optimal complexity associated with their size (i.e., the numbers of variables and of constraints) and with institutional considerations which promulgate near-optimal solutions as useful alternatives to global optima (which might be only marginally superior in terms of the stated objective function). The third portion is a systematic appraisal of optimal and near-optimal solutions to systems of modest size, with emphasis on strategies for capacity expansion. It is shown that many near-optimal solutions are often very close to the global optimum, frequently within the error attributed to noise in the parameters of the optimum. The axiom that optimality should always be sought is shown to be indefensible. An example is run on a model river basin.
W80-03750

A TECHNIQUE FOR ESTIMATING HEIGHTS REACHED BY THE 100-YEAR FLOOD ON UNREGULATED, NONTIDAL STREAMS IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-03764

SELECTED HYDROLOGIC DATA FOR SPOKANE VALLEY, SPOKANE, WASHINGTON, 1977-78,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-03769

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
For primary bibliographic entry see Field 6E.
W80-03859

SPATIAL ASPECTS OF THE PRESSURE FOR SHORELINE DEVELOPMENT: THE EXAMPLE OF PUGET SOUND,
Ottawa Univ. (Ontario). Dept. of Geography and Regional Planning.
For primary bibliographic entry see Field 6E.
W80-03884

6B. Evaluation Process

RIVER-QUALITY ASSESSMENT: CONCEPT, FRAMEWORK, AND APPLICATION IN THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR.
D. A. Rickert.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 11-21, 1978. 2 Fig, 18 Ref.

Descriptors: *Water quality, *River basins, *Oregon, *Decision making, Planning, Programs, Management, Project purposes, Analytical techniques, Mathematical models, Water pollution, Pollutants, Dissolved oxygen, Metals, Assessments, Priorities, Hydrology, Forecasting, *Willamette River Basin(OR), Assessment framework, River-quality assessment.

The U.S. Geological Survey recently (1976) completed an intensive river-quality assessment in the Willamette River basin, Oregon. The major objectives were to (1) define a practical framework for conducting river-quality assessments that will provide a sound technical basis for decision makers to use in evaluating planning and management alternatives, and (2) apply the framework to assess existing or potential river-quality problems of the Willamette River basin. The most noteworthy finding of the assessment was that across-the-board advanced waste treatment is not the answer to the problem of meeting stringent water-quality standards established for the Willamette River. The implication of this finding is that rigid nationwide standards and regulations are likely to result in unneeded expenditures in some river basins and in unachieved standards in others. The assessment also found that existing water-quality data collected under monitoring- and surveillance-type programs are inadequate for defining the critical cause-effect relationships that control river-quality problems. Intensive, synoptic surveys specifically designed to assess local problems and conditions are required to provide an adequate information base for making key management decisions. Perhaps the three most important questions that need to be asked at the beginning of each study are: (1) Have the relevant problems been delineated. (2) What types and intensities of data collection are needed to provide a technically sound assessment. (3) How much time is needed to provide information that is adequate for decision making. The ultimate success of resource assessment is largely determined by its initial formulation. Careful answers to these questions, together with thoroughly defined objectives, will provide a sound start to each new assessment. (See also W80-03606) (Humphreys-ISWS)
W80-03608

RESIDUALS MANAGEMENT: A TOOL IN RIVER-QUALITY ASSESSMENT APPLIED TO COAL DEVELOPMENT IN THE YAMPA RIVER BASIN, COLORADO,
Geological Survey, Reston, VA.
R. M. Hirsch, I. C. James, II, and J. E. Schefter.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 142-164, 1978. 3 Fig, 7 Tab, 17 Ref, 1 Append.

Descriptors: *River basins, *Colorado, *Long-term planning, *Model studies, *Regional analysis, Planning, Water utilization, Coals, Costs, Economics, Industrial plants, Consumptive use, Management, Thermal powerplants, Resources development, *Yampa River Basin(CO), Coal development, Plant-level models, Regional models, Coal gasification, Electric power generation.

Residuals management provides a basis for projecting the effects of economic development on the discharge of residuals to the environment and on the use of water. It is a useful technique of river-quality assessment for basins wherein substantial

economic growth is either occurring or expected. Residuals management techniques were utilized to assess the effects of coal development and utilization in the Colorado part of the Yampa River basin. Plant-level models were used to describe the material and energy balances and the operating costs of surface mining of coal, the Synthane process of coal gasification, coal-fired thermal-electric generation of power transportation of coal by coal-slurry pipeline, and transportation by unit train. As part of the model of electric power generation, four alternative methods of cooling are considered: once-through cooling, cooling ponds, wet cooling towers, and dry cooling towers. Each of these models provides estimates of water withdrawal, water consumption, and residuals generated directly by the particular process involved. An economic input/output model of the study was used to predict the total growth of the regional economy under four coal-development scenarios. The amount of coal assumed to be mined is constant across all of these, but each of them assumes a different use of the 'new' coal: gasification, electric power generation, coal-slurry pipeline export, or unit train export. The plant-level models are linked with the input/output model to provide estimates of total (direct and indirect) water use and residuals generation in the regional economy under the four scenarios. (See also W80-03606) (Humphreys-ISWS)
W80-03616

A CULTURAL RESOURCE SURVEY OF THE TETON REPLACEMENT FARMLAND, JEFFERSON COUNTY, IDAHO,
Commonwealth Associates Inc., Jackson, MI.
J. G. Franzen.
Final Investigative Report No R-2092, Volume I, submitted to USDI Water and Power Resources Service, January 1980. 70 p, 2 Fig, 4 Tab, 33 Ref, 2 Append.

Descriptors: *Idaho, *Archaeology, *Dating, *Agriculture, *Flood damage, Surveys, History, Land use, Farms, Irrigation practices, Sands, Silts, Arid lands, Teton Dam(Idaho).

An intensive survey was conducted to evaluate the historic and cultural properties of 3200 acres of land along Idaho State Route 33 that is to be sold to farmers as replacement farmland for lands damaged by flood waters when the Teton Dam failed. The area is located on the Snake River Plain and is part of the Columbia Intermontane Physiographic Province. Dunes of sand and silt dominate the topography of the area. The land is semi-arid (7.5 in/year rainfall), has low humidity, a large temperature range, and large yearly variations in seasonal conditions. For the survey parallel transects were walked over the entire area at approximately 30 meter intervals. Test excavations were performed at three sites where subsurface deposits were indicated and all soil was screened through 1/4 inch hardware cloth. The survey located 25 archeological sites and 56 isolated artifact finds. Of these 22 sites with chipped stone tools, debitage, and faunal materials were dated to the pre-historic period. These prehistoric sites may be related to the procurement and processing of bison, antelope, or grass seeds. Site descriptions are given for each of the 25 archeological resource areas. Due to the destructive nature of planned irrigated agriculture in the area a program of mitigation is recommended for controlled surface collection and functional-spacial analysis. (Seigler-IPA)
W80-03778

EFFECTS OF MECHANICAL CUTTING ON SUBMERSED VEGETATION IN A LOUISIANA LAKE,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
For primary bibliographic entry see Field 4A.
W80-03832

STREAM TYPES IN IDAHO: AN APPROACH TO CLASSIFICATION OF STREAMS IN NATURAL AREAS,
Idaho Univ., Moscow. Dept. of Biological Sciences.
N. L. Savage, and F. W. Rabe.
Biological Conservation, Vol 15, No 4, p 301-315, June, 1979. 5 Fig, 6 Tab, 23 Ref. OWRT A-046-IDA(3).

Descriptors: *Streams, *Classification, *Idaho, Gradient, Flow characteristics, Substrate, Wetlands, Aquatic plants, Aquatic animals, Aquatic habitat, Biological communities, Physical properties.

A preliminary classification for unaltered low order streams in Idaho consists of ephemeral streams, which contain water only during periods of high runoff; spring streams, formed where groundwater aquifers discharge as surface springs; and three types of permanent streams. Key features used to designate stream type are order, gradient, pattern of flow, and substrate--all of which are readily identifiable, nonvariable characteristics. Type designation is supported on an ecological basis by analysis of extensive collections of aquatic plants and invertebrates. (Howard-Mass)
W80-03835

FORMULATING AQUATIC WEED MANAGEMENT PROGRAMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03841

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR DISTILLATION FOR LARGE SCALE PRODUCTION IN FRESH WATER.
Bechtel Corp., San Francisco, CA. Research and Engineering.
For primary bibliographic entry see Field 3A.
W80-03842

IMPACTS OF THE WESTERN DROUGHT ON THE REGIONAL ELECTRICITY SITUATION.
For primary bibliographic entry see Field 6D.
W80-03843

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, APPENDIX 3. ECONOMIC AND SOCIAL PROFILE.
Baltimore District, U.S. Army Corps of Engineers, Baltimore, Maryland, Corps of Engineers, Baltimore, MD. Baltimore District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 473, Price codes: A14 in paper copy, A01 in microfiche. Interim report, December 1977. 296 p, 27 Fig, 143 Tab.

Descriptors: *Regional economics, *Regional analysis, *Chesapeake Bay, *Forecasting, *Social aspects, Regional development, Water requirements, Economic impact, Economic prediction, Economics, Regions, Human population, Urbanization, Land use, Recreation, Water demand, Navigable waters, Water pollution sources, Water supply, Waste water treatment, Growth rates.

As one of 16 supporting appendices to the second part of a three-phase comprehensive study of Chesapeake Bay, the present document provides an economic and social history of the region, describes population characteristics, analyzes the main economic standard industrial classification sectors, and derives economic and demographic projections through standardized models developed for sub-national areas. Chesapeake Bay Region, heavily urbanized today, forms the southern portion of the Boston-Washington megalopolis considered widely to be the economic center of the U.S. With a population that has doubled since 1940 to about 8 million, the Bay region is expected to double in population growth once again by 2020, with more than 50% of this projected to take place in the Washington D.C. subregion. Almost 3.3 million persons were employed in the Bay region in 1970, with 6.8 million projected by 2020. Although less than 10% of the land is developed, nearly 80% of the population live in urban areas. Land use is characterized by: (1) increasing industrial demands for processing and cooling water; (2) water-based recreational facilities and opportunities outstripped by booming demand; (3) adverse impacts brought about by expansion of navigational facilities to keep pace with economic expansion; (4) continued pollution and sedimentation of region waterways as a result of construction, industrial effluents, storm runoff and municipal discharges; and (5) shortage of adequate water supply and waste treatment facilities. (Harris-Wisconsin)
W80-03844

ESTIMATING WILLINGNESS TO PAY: WHY AND HOW.,
Stockholm Univ. (Sweden).
P. Bohm.
Scandinavian Journal of Economics, Vol 81, No 2, p 142-153, 1979. 1 Fig, 14 Ref.

Descriptors: *Demand, *Willingness-to-pay, *Estimating, *Decision making, *Social aspects, *Political aspects, Economics, Public sector, Estimating equations, Curves, Theoretical analysis, Social change, Social values, Social needs, Governments, Economic impact, Risks, Analytical techniques, Political constraints, Institutional constraints.

Demand-revealing methods for public goods must meet minimum standards of intelligibility and quality control in order for experiments and other applications of direct decision making in society to be acceptable to government. If standards are not met, politicians and ordinary people will not be convinced that public choice by direct, demand-revealing methods represents an improvement over previous choice methods. Demand-revealing methods are relevant whenever government cannot reach a well-founded decision, that is, in highly controversial cases or in cases involving important matters of principle. Demand-revealing methods should not be used in everyday political decision making. Economic incentives may or may not influence responses with respect to issues of high moral content. Uncertainty basically remains as to whether economic incentives will dominate or be dominated by other incentives. It is important to look for demand-revealing mechanisms with no incentives for misrepresenting preferences. Judgements must be made regarding whether bias is absent in a particular application, not only in principle but also in a laboratory setting. (Danovich-Wisconsin)
W80-03846

HEDONIC PRICES, PROPERTY VALUES AND MEASURING ENVIRONMENTAL BENEFITS: A SURVEY OF THE ISSUES,
Bowdoin Coll., Brunswick, ME.
A. M. Freeman, III.
Scandinavian Journal of Economics, Vol 81, No 2, p 154-173, 1979. 3 Fig, 37 Ref.

Descriptors: *Benefits, *Prices, *Theoretical analysis, *Analytical techniques, *Property values, Economics, Demand, Willingness to pay, Curves, Environment, Equilibrium prices, Mathematical models, Utility, Supply, Equations, Air pollution, Cities.

Hedonic price techniques for estimating benefits work about as well or as poorly as any empirical technique for estimating economic functions. Hedonic technique assessment involves substantial simplification and abstraction from complex reality. Assumptions are never completely realized in practice. Criticisms raised against these techniques can be raised against any economic empirical work: data are inadequate: variables are measured with error; and variable definitions seldom correspond precisely to theoretical constructs. This paper reviews the theoretical basis and assumptions of hedonic price equations derived from property value data to obtain prices and inverse demand functions for environmental amenities such as air quality. Review involves two separate and conceptionally distinct steps: using the hedonic price equation to estimate marginal implicit characteristic prices, and using these implicit prices to estimate inverse demand functions or marginal willingness to pay functions for household groups. Results from more than a dozen studies assessing

air, water quality and urban noise problems, indicate the model has substantial explanatory power with respect to housing prices. (Danovich-Wisconsin)
W80-03847

WHAT CAN WE GET FROM EFFLUENT CHARGES,
C. S. Russell.
Policy Analysis, Vol 5, No 2, p 155-180, Spring, 1979. 1 Tab.

Descriptors: *Effluents, *Pollution taxes(Charges), *Economic efficiency, *Policy, Economics, Political aspects, Regulation, Federal government, Discharge(Water), Water quality standards, Marginal costs, Benefits, Economic growth, Technology, Taxes, Decision making, Environment.

This paper discusses effluent charges as environmental policy instruments and advocates trading effluent charges efficiency for a simpler system, retaining dynamic incentive effects that are the major positive attributes of charges. Statically efficient charges are information-intensive and most vulnerable to litigation delays. If charges are viewed as policy targets, static efficiency is not meaningful. If charge levels are set by Congress, political considerations are central to levels chosen and little is gained by legal challenges. If charge levels are chosen by The U.S. Environmental Protection Agency, information is required to justify technical decisions. Political pressure and bargaining are important at every stage; legal challenges may involve successful delays in implementation. Over the long-run, any charge system spurs firms and public bodies to search for better and cheaper ways to avoid discharging pollution into air and water. A realistic and potentially useful policy would be to combine part of the existing regulatory apparatus with nationally uniform effluent charges covering all significant pollutants. In addition, all discharges would be subject to national effluent charges, creating continuing incentives for developing and adopting environment-saving innovations. This policy is roughly consistent with the charges-as-targets position; such a course would not produce economic efficiency in the static sense of minimum pollution expenditures for attained ambient quality levels. (Danovich-Wisconsin)
W80-03849

FINANCIAL STATEMENT MODELING: ANALYZING THE POLLUTION-CONTROL TAX INCENTIVE,
L. A. Nikolai, R. Elam, and B. Bozeman.
Policy Analysis, Vol 5, No 2, p 243-254, Spring, 1979. 2 Fig, 3 Tab.

Descriptors: *Policy, *Pollution taxes(Charges), *Financial feasibility, *Investment, Mathematical models, Economics, Statistical methods, Statistics, Taxes, Pollution abatement, Legislation, Regulation, Tax rates, Depreciation, Amortization, Capital, Industries, Cost-benefit analysis, Economic justification.

Financial statement modeling, used to evaluate congressionally mandated pollution-control tax incentives, concludes that such tax incentives are ineffective. On an investment of $900,000, the maximum total present value tax savings amounts to less than $60,000 for a manufacturing firm investing in a facility with a 26-year life. The Internal Revenue Code includes provisions for investment credit, bonus depreciation, and certified pollution control facility accelerated amortizations to stimulate capital expenditures. Financial statement modeling is an approach to policy analysis which employs financial data and evaluates alternatives in terms similar to cost-benefit analysis, but financial statement modeling is rooted in concepts used by accountants rather than economists. It is a useful modification of cost-benefit analysis and yields sufficiently different results. Current tax provisions are ineffective for several reasons: (1) Due to rapidly improving pollution control technology, firms given a choice between comparable short and long-term alternatives usually opt for the short-term facility. (2) Allowable asset time spans for selected high environmental impact industries are less than those necessary to make tax incentives financially attractive. (3) Tax deductions are not sufficient to justify trying to get facilities certified by the appropriate pollution control agency. (4) Tax provisions tend to discriminate against extractive firms. (Danovich-Wisconsin)
W80-03850

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
I. Livingstone, and A. Hazlewood.
Oxford Bulletin of Economic and Statistics, Vol 41, No 1, p 21-35, February, 1979. 4 Fig, 1 Tab.

Descriptors: *Economics, *Irrigation, *Developing countries, *Water supply, *Risks, *Economic efficiency, *Optimization, Water resources, Equations, Curves, Water shortage, Water management(Applied), Agriculture, Irrigation design, Irrigation systems, Irrigation water, Irrigation efficiency, Marginal utility, Capital, Investment, Social aspects.

Fluctuating water availability is an issue which arises in planning irrigation schemes in developing countries due to differences in rainfall. A recognized rule-of-thumb in engineering practices recommends that the volume of water assumed for planning purposes should be available in four years out of five. Only in one year out of five will water be insufficient for installed capacity. Such a rule provides an optimal solution only in particular circumstances and its general application is inconsistent with standard net present value criterion for evaluating alternative investment projects. These rules should be determined, not on technical, but on economic and social grounds. A large mechanized farm may not accept frequent serious water deficiency, involving large financial losses. However, it is different for village irrigation with peasant production. If peasant farmers are poor with low incomes and food supply, they attach high values to extra output, even if available only in better years. Denying cultivators the full benefits of high river flow years so as to reduce risks of doing relatively worse in other years is not important. If crop storing is possible, a larger area could produce extra food in good years to be used as a reserve against subsequent crop failure. Therefore, the optimum solution shows that peasant farmers may follow a less cautious policy than a large mechanized farm. (Danovich-Wisconsin)
W80-03851

ENVIRONMENTAL PROTECTION FOR WHOM,
Hampshire Coll., Amherst, MA. Dept. of Political Science.
S. P. Shapiro.
Social Policy, Vol 10, No 1, p 24-28, May-June 1979. 23 Ref.

Descriptors: *Environment, *Political aspects, *Leadership, *Psychological aspects, *Pollution abatement, Political constraints, Natural resources, Economics, Employment opportunities, Under-employment, Welfare(Economics), Social participation, Social aspects, Water policy, Water resources development, Income distribution, Conservation, Decision making.

Resource conservation and environmental protection are commonly perceived as elitist movements with leadership made up of wealthy primitivists and other persons unconnected to and unconcerned with the basic needs and concerns of most of the working class of the United States. A paradox is that environmentalism has been a highly divisive issue, driving a wedge between the often tenous alliance of labor and middle-class liberals and excluding those for whom pollution poses the greatest threat: the urban working poor, miners, etc. At the same time, environmental policy is also seen as a 'safe' issue--unlikely to upset or even challenge the existing political and economic structures within the United States. Its concern is mainly for those with the least interest in any major change in American society. Forgetting that any justification for less growth is necessarily a justification for existing levels of inequality in this country, many Americans find themselves caught between two apparently impossible extremes on environmental issues. First, success of the movement may be costly in terms of jobs and economic well-being so as to cause a severe backlash; and hard-core environmentalists readily take on an elitist cast, as their myopia about social conditions at times suggests more concern with aesthetics than people and jobs. Second, the environmental movement provides industry with potential political allies of organized labor and the poor, in its struggle against more effective environmental legislation. (Harris-Wisconsin)
W80-03853

ADAPTIVE ECONOMICS AND NATURAL RESOURCES POLICY,
University of Southern California, Los Angeles. Dept. of Economics.
R. H. Day.
American Journal of Agricultural Economics, Vol 60, No 2, p 276-283, May 1978. 29 Ref.

Descriptors: *Economics, *Natural resources, *Decision making, *Adaptation, Federal project policy, Water allocation(Policy), Water distribution(Policy), Water policy, Administration, Management, Economic justification, Methodology, Optimization, Equilibrium, Environmental effects, Planning, Behavior, Economic efficiency, Systems analysis.

An approach to economics differing sharply from (but closely related and complimentary to) optimality and general equilibrium theory is presented which has special relevance to natural resources policy. Adaptive economics is based on the following postulates of human behavior: (1) Economic activity changes the environment in which further activity is conceived and executed: results of this activity, such as resource exhaustion or irreversible environmental effects, may be far more consequential than the setting in which it takes place. (2) Economizing is carried out by agents who are partially informed, have limited memory and computational powers, and who make only imperfect forecasts of the effects of their choices. (3) Current knowledge derives from only past system operation. (4) Economic activity, including planning, takes time; delays interfere with plans, actions and consequences. (5) Plans and behavior are imperfectly coordinated, so that economic behavior takes place out of equilibrium. Adaptive economics is primarily a study of how economies shift in disequilibrium and secondarily whether or not, and if so, how equilibria or adaptedness states are achieved. Adaptive models will produce surprises in the evolution of economic activity whose exact timing and magnitude defy prediction. Instead of focusing on economic efficiency, natural resources policy should be aimed at preparing for surprises and not on predicting them--perhaps a contradiction in terms. What is needed is slack: surplus resources, redundancies, expectation of less than maximal growth, operational delays, and procedural mistakes. (Harris-Wisconsin)
W80-03854

ENVIRONMENTAL MANAGEMENT IN GENERAL EQUILIBRIUM: A NEW INCENTIVE COMPATIBLE APPROACH,
Mannheim Univ. (Germany, F.R.).
R. Pethig.
International Economic Review, Vol 20, No 1, p 1-27, February 1979. 2 Fig, 23 Ref.

Descriptors: *Economics, *Environment, *Resource management, *Pollutants, *Mathematics, Mathematical models, Production, Equations, Equilibrium, Theoretical analysis, Curves, Mathematical studies, Optimization, Governments, Resource allocation, Competition, Welfare(Economics).

Main results of applying the Groves-Ledyard mechanism to environmental management are an existence theorem of competitive equilibrium relative to incentive-compatible environmental management and two Fundamental Welfare Theorems for pollution economy. The Groves-Ledyard con-

struction does not address or resolve some major informational problems involved with pollution; its main purpose is to elicit correct information on consumer preferences. Environmental management is studied only in a static general equilibrium model. Firms and consumers produce private goods, some of them being undesired by-products. Residual waste products are defined as private goods in aggregate excess supply, a satisfactory micro-economic basis for explaining pollution. A central part of the model is the pollution function which is viewed as the economy's production function for public goods. If spatial and temporal interpretation of commodity space is adopted, pollution function knowledge is an important informational problem in environmental economics. Consumers are concerned only about pollution levels and not about residual allocations which lead to these levels; therefore, only government has complete information on the pollution function. However, knowledge of the pollution function does not exhaust Groves-Ledyard mechanism informational feasibility with environmental management issues. (Danovich-Wisconsin)
W80-03855

SYSTEMS ECOLOGY, PEOPLE ECOLOGY, AND THE ANTHROPOLOGY OF FISHING COMMUNITIES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Human Ecology and Social Sciences.
B. J. McCay.
Human Ecology, Vol 6, No 4, p 397-422, December 1978. 2 Tab, 98 Ref.

Descriptors: *Commercial fishing, *Economics, *Social impact, *Anthropology, *Social adjustment, *Behavior, Fisheries, Marine fisheries, International waters, Fogo Island, Newfoundland, Canada, Social aspects, Social change, Social needs, Social values, Employment, Social mobility, Ecology, Political aspects, Employment opportunities, Under-employment, Unemployment, Adaptation, Fish management, Systems analysis.

Data from research among fishermen of Fogo Island, New foundland are used to explore 'people ecology', an alternative to marine anthropology which emphasizes people in place of systems as starting points for study, and underscores the role of larger political and social processes which affect local fishermen. During a period of local fishery decline, two general adaptive strategies were observed among Fogo Islanders. Diversification as one strategy involved broadening alternatives both within fishing and between fishing and other modes of making a living. This adaptive strategy appears to have been the most general and traditional approach, and characterized responses to individuals and households to a fisheries decline in the early 1960s. However, as environmental and economic problems continued and worsened, many people began to adjust in ways which involved intensification of response: going on welfare, becoming wage laborers, leaving the island, or dropping their independent status to team up in larger boats to remain in commercial fishing. However, the shift from diversification to intensification strategies on Fogo Island cannot be viewed simply in relation to the local natural environment. Similarly observed shifts from individual to group units of purposive action was simulated by the involvement of 'outsiders' in local matters and made possible by the structural dependency of small Newfoundland outport communites on the Canadian government. (Harris-Wisconsin)
W80-03860

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GUIDELINES FOR SOCIOECONOMIC IMPACT ANALYSES OF ENVIRONMENTAL REGULATIONS,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
D. Hargett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149263, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina, Raleigh, Rpt No 149, Dec 1979. 68 p, 15 Fig, 7 Tab. OWRT A-101-NC(2), 14-34-0001-8035.

Descriptors: *Cost-benefit analysis, *Regulations, *Decision-making criteria, Net present value, Internal rate of return, Water quality, Recreation, Flood control, Welfare maximization, Sensitivity analysis, *Water utilization, Cost-benefit, *North Carolina, Socio-economic impact analysis, Decision-making, Criteria, Economics, Water resources.

This report presents a brief description of socioeconomic impact analyses for noneconomists. Emphasis is given to the concept of economic efficiency or to the use of socioeconomic or benefit-cost analysis to enhance state and national income. Economists have not been very successful at conveying their ideas concerning benefit-cost analysis to noneconomists. One reason is a lack of consensus among economists on certain aspects. Aspects of benefit-cost analysis that are particularly troublesome for noneconomists are stressed. Some of these include: marginal analysis of welfare maximization, normalized pricing, estimations of willingness to pay, economics of information, and the social rate of discount. Examples are briefly described, and references are offered to several publications that have had the same purpose. (Kiger-NC)
W80-03602

ESTIMATING WATER TREATMENT COSTS, VOLUME 4. COMPUTER USER'S MANUAL FOR RETRIEVING AND UPDATING COST DATA,
Culp/Wesner/Culp, Santa Ana, CA.
For primary bibliographic entry see Field 5F.
W80-03655

A BIOECONOMIC MODEL OF THE GULF OF MEXICO SHRIMP FISHERY,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 8I.
W80-03845

ESTIMATING WILLINGNESS TO PAY: WHY AND HOW.,
Stockholm Univ. (Sweden).
For primary bibliographic entry see Field 6B.
W80-03846

HEDONIC PRICES, PROPERTY VALUES AND MEASURING ENVIRONMENTAL BENEFITS: A SURVEY OF THE ISSUES,
Bowdoin Coll., Brunswick, ME.
For primary bibliographic entry see Field 6B.
W80-03847

PIGOVIAN TAXES, POLLUTER SUBSIDIES, REGULATION, AND THE SIZE OF A POLLUTING INDUSTRY,
York Univ., Downsview (Ontario).
For primary bibliographic entry see Field 6E.
W80-03848

FISHERMEN'S REMUNERATION SYSTEMS AND IMPLICATIONS FOR FISHERIES DEVELOPMENT,
Rhode Island Univ., Kingston.
J. G. Sutinen.
Scottish Journal of Political Economy, Vol 26, No 2, p 147-162, June 1979. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Commercial fishing, *Income distribution, *Risks, *Theoretical analysis, *Resources development, Economics, Fishing, Income, Equations, Investment, Labor, Capital, Employment, Wages, Payment, Fish harvest, Mathematical models, Competition, Water resources development, Fisheries.

Theoretical economic analysis demonstrates that the share system of remuneration makes a significant contribution to fishing industry development. This paper describes conditions under which the share system of remuneration is preferred by relevant parties in the fishing industry and examines implications for fisheries development. The theory argues that competitive labor markets set the level of welfare for marginal fishermen; they are neither better nor worse off under any other remuneration system. Also, if share systems are abolished and replaced by wage systems, the total number of fishermen and their individual incomes would decline. Fishing entrepreneurs are better off with the share system. It allows spreading some risk among the crew, thus reducing risk-bearing costs and providing work incentives which makes it less costly to extract desired work from the crew. Since unit costs are lower under share systems, output and input utilization levels should be greater than under wage or remuneration systems. An entrepreneur's incentive to invest is not mitigated as long as competitive markets prevail. Competitive markets allow for changes in remuneration arrangements to accomodate new capital equipment additions. Changes can involve the fixed payment, share, or both. (Danovich-Wisconsin)
W80-03858

6D. Water Demand

RESIDUALS MANAGEMENT: A TOOL IN RIVER-QUALITY ASSESSMENT APPLIED TO COAL DEVELOPMENT IN THE YAMPA RIVER BASIN, COLORADO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 6B.
W80-03616

AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL,
Technion-Israel Inst. of Tech., Haifa. Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W80-03742

IMPACTS OF THE WESTERN DROUGHT ON THE REGIONAL ELECTRICITY SITUATION.
Available from the National Technical Information Service, Springfield, VA 22161 as FEA-G-77-360, Price codes: A08 in paper copy, A01 in microfiche. Joint Staff Report: Federal Power Commission and Federal Energy Administration, September 30, 1977. 81 p, 2 Fig, 10 Tab, 8 Append.

Descriptors: *Droughts, *Hydroelectric power, *Pacific Northwest U.S., *Water conservation, *Water policy, *Long term planning, Regulation, Hydrologic budget, Low flow, Rationing(Water), Water shortage, Hydroelectric plants, Pacific Coast region, Idaho, Oregon, California, Washington, Canada, Water distribution(Applied), Water management(Applied), Regional analysis, Regional development.

Drought conditions during winter 1976-77 decreased the ability of some hydroelectric plants in the Pacific Northwest to produce sufficient electric energy; effects are especially notable in the area of the Northwest Power Pool (NWPP) serving parts of 14 states and western Canada, where 66.3% of winter energy is from hydroelectric facilities. Projected electrical demand and supply relationships are given. While the outlook for NWPP is dependent on precipitation during fall and winter months, it is unlikely that existing water shortfalls can be replenished although increased precipitation may alleviate problems in some subareas. Short-term recommendations include: (1) Federal and state agencies must adopt and implement strong conservation measures and continuously monitor the drought. (2) Federal drought programs should be continued year-round in NWPP. (3) Programs to minimize impacts on agriculture, fish and wildlife should take precedence over minor losses in electric generation. Long-term recommendations center generally on extended efforts to promote electric energy conservation, but other specific measures are also advised: (1) A direct current power line should be constructed between Arizona and Oregon for greater future

exchange flexibility. (2) The Bonneville Power Administration should make provision for passing on thermal costs significantly greater than usual. (3) Legislation is needed for electrical energy emergency allocations. (4) The appropriateness of increasing interconnections between eastern and western U.S. bulk power systems should be examined. (Harris-Wisconsin)
W80-03843

CHESAPEAKE BAY FUTURE CONDITIONS REPORT. APPENDIX 3. ECONOMIC AND SOCIAL PROFILE.
Baltimore District, U.S. Army Corps of Engineers, Baltimore, Maryland, Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 6B.
W80-03844

6E. Water Law and Institutions

PUBLIC WATER SUPPLIES: THE EFFECT OF FEDERAL AND TENNESSEE WATER RESOURCE LAW,
East Tennessee State Univ., Johnson City.
V. A. Sikora.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149271, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research center, University of Tennessee, Knoxville, Research Report No 72, December 1979. 87 p, 6 Tab, Append. OWRT A-055-TENN(1), 14-34-0001-9045.

Descriptors: *Water law, *Water rights, Riparian rights, Common law, Judicial decisions, Water policy, Water supply, *Tennessee, *Federal-State water rights conflicts, Eminent domain.

The water law in Tennessee was determined by a legal evaluation of Tennessee statutes and cases as they affect Tennessee's water supplies. Once the existing law was determined, it was evaluated for its effect upon securing adequate water supplies for public water systems. The opinions of public water suppliers were obtained by means of a questionnaire which was mailed to all Tennessee public water suppliers. The study has determined, first, under both common law and Tennessee statute public water suppliers have nearly the same ability as other persons to acquire water rights. In addition, public water suppliers have ample eminent domain power delegated to them to acquire property and water rights. Second, public water suppliers under Tennessee riparian doctrine appear to have a priority over other withdrawers from a watercourse. In conflicts between withdrawal uses and instream uses both parties seem to be required to follow the correlative rights doctrine except for navigational uses which seem to dominate all other uses, including withdrawal uses. Third, public water suppliers favor a state water resource management program operated by a public health agency. Most suppliers saw a decline in the reliability of their primary water source in the next 20 years. Fourth, the Tennessee court cases on water law are 50-100 years old and based on problems in a culture which no longer exists. There are many substantial and significant gaps in the case law which could be filled by appropriate legislation. And finally, federal law and agencies have a pervasive, though not exclusive, roll in management of water in Tennessee.
W80-03601

RIVER-QUALITY ASSESSMENT--A RATIONAL SCIENTIFIC BASIS FOR POLLUTION CONTROL AND WATER-QUALITY MANAGEMENT,
For primary bibliographic entry see Field 5G.
W80-03607

LIABILITY FOR OIL POLLUTION - UNITED STATES LAW,
Glassie, Pewett, Beebe and Shanks, Washington, DC.
A. I. Mendelsohn, and E. R. Fidell.
Journal of Maritime Law and Commerce, Vol 10, No 4, p 475-496, July 1979.

Descriptors: *Oil pollution, *Oil spills, *Federal Water Pollution Control Act, *Water pollution control, Environmental effects, Water law, Federal government, Legal aspects, Oil industry, Oceans.

Few areas of law are as complex as that governing liability for oil pollution. The subject involves principles of tort law, largely judge-made admiralty doctrines, legislative enactments, and international conventions. The interplay of federal and state law provides further complexity. Perhaps the greatest difficulty may be the lack of comprehensive federal legislation. There are several federal statutes that are relevant to oil pollution liability. The 1851 Limitation of Liability Act dealt with the general liability of shipowners. The 1972 Federal Water Pollution Control Act Amendments pertained to water pollution in general and included the regulation of oil pollutant discharges. The 1973 Trans-Alaska Pipeline Authorization Act allowed private parties to recover for oil pollution damage. Various other acts since 1973 have dealt with specific aspects of oil pollution control. New broader legislation has been proposed in Congress. Current American law attempts to reconcile the diverse interests in oil pollution liability. Comprehensive legislation is probably the best method to achieve that aim. (Wilson-Florida)
W80-03667

A REVIEW OF NEW COLORADO WATER AND AIR POLLUTION LEGISLATION,
J. Bermingham, and J. Raisch.
The Colorado Lawyer, Vol 2, No 11, p 1-10, September 1973.

Descriptors: *Colorado, *Water quality control, *Sewage disposal, Legislation, Legal aspects, Water law, Pollutants, Water pollution, Environmental control, Sewage, Water quality act.

The 1973 Colorado General Assembly passed a number of environmental bills, some of which have significant and sweeping impact. The Water Quality Act (WQA) was adopted with two goals in mind: (1) to improve existing water pollution legislation; and (2) to comply with the requirements of the 1972 Federal Water Pollution Control Act Amendments. The WQA provides for a Water Quality Control Commission with powers to adopt control regulations and to promulgate water quality standards and waste discharge permit regulations. The administration and enforcement functions have been transferred to the Division of Administration of the Department of Health. House Bill 1553, The Individual Sewage Disposal Systems Act (ISDSA), authorizes the establishment, administration and enforcement of minimum standards, rules and regulations for individual sewage disposal systems. The ISDSA details minimum standards for systems which must be included in all local or state rules and regulations. The General Assembly also introduced amendments to the Colorado Air Pollution Act. Senate Bill 393 dealt with control of pollution from motor vehicles. (Wilson-Florida)
W80-03668

AMERICAN BAR ASSOCIATION RESOLUTION RE NATURAL RESOURCES OF THE SEA ADOPTED BY THE HOUSE OF DELEGATES, AUGUST 6, 1973 AND REPORT OF THE SECTION OF NATURAL RESOURCES LAW RECOMMENDING ADOPTION OF THE RESOLUTION.
American Bar Association, Washington, DC. Natural Resources Section.
Natural Resources Lawyer, Vol 6, No 4, p 589-633, Fall 1973.

Descriptors: *Resource allocation, *International law, *Water resources development, Water law, Resources, Resource development, International waters, International joint commission, Water resources, United Nations.

In response to and in anticipation of United Nations conferences on the law of the sea, the American Bar Association (ABA) passed this resolution, stating its position regarding natural resources of the sea. The resolution addresses: (1) the allocation of seabed resources of the continental margin and those outside the margin; (2) fishing interests; (3) protection of the environment; (4) the need for unimpeded navigation and transportation; (5) assurance of investment integrity; (6) scientific research; and (7) determination of disputes. Accompanying the resolution is a report which traces the history of United Nations actions regarding the law of the sea, particularly the attempts to create an international regime for the exploration and exploitation of seabed resources beyond the limits of national jurisdictions. The major points of the ABA resolution and their historical backgrounds are developed. The most important components of an equitable regime are set forth: The selection of the governing body and the role of the regime. Consideration is given to reasonable and secure investment conditions, to the President's Statement on United States Oceans Policy of May 23, 1970, and to the question of the number of treaties necessary. (Swanson-Florida)
W80-03695

THE ECONOMIC CONSEQUENCES OF ALLOCATING GROUNDWATER TO COMPETING INTEREST IN THE SANTA CRUZ BASIN, PIMA COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
J. C. Wade, and A. H. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151483, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Project Completion Report, February 26, 1980. 22 p, 1 Fig, 33 Ref, OWRT A-087-ARIZ(3), 14-34-0001-9003.

Descriptors: *Economics, *Aquifer management, *Water rights, *Water user, *Legal aspects, Indian reservations, Water supply, Arizona, Pima County(Ariz), *Tucson Basin, Indian water rights, Papago Tribe.

The groundwater in the Tucson Basin is being drawn faster than it is replenished by nature. The water table is falling, giving rise to several conflicts between water users in the Basin. Several lawsuits are in progress, including an action by the Papago Tribe against some of the major water users in the Basin. Largely because of these difficulties, the State Legislature has established a commission to make proposals for the reform of Arizona's groundwater law. The pattern of water use in the Basin will undoubtedly be changed by the outcome of the present litigation and the coming reform of Arizona's groundwater law. This report gives a short summary of a research project which has studied how water use in the Basin might be affected by changes in the availability of water. The report also gives an account of the effects that these changes in water use could have on the region's economy. The report concludes that the water problems of the Tucson Basin will have little effect on the region at large and that these problems are simply a matter for the Indians and the other water users in the Basin to sort out amongst themselves.
W80-03707

COPPER MINING FROM UNDER LAKE SUPERIOR: THE LEGAL ASPECTS,
F. M. Tuerkheimer.
Natural Resources Lawyer, Vol 7, No 1, p 137-155, Winter 1974.

Descriptors: *Michigan, *Lake Superior, *Mining, Great Lakes, Legislation, Mineral industry, Water pollution, Boundaries, Treaties, Legal aspects, Copper.

Detailed geological studies of the Lake Superior Basin have revealed the high probability of rich copper deposits. Three sets of laws are directly relevant to the exploitation of such copper deposits: (1) international law as reflected in the 1903 Boundary Waters Treaty; (2) United States law as reflected in the 1899 Refuse Act; and (3) state law as reflected in Michigan statutes. Boundary waters,

as defined by the U.S.-Canada treaty, include any body of water through which the international boundary runs. Thus, Lake Superior is subject to Article IV of the treaty which states that boundary waters shall not be polluted. U.S. law is applicable in that Lake Superior is navigable waterbody. The 1899 Refuse Act requires Army Chief of Engineers authorization to build a structure such as a mining platform, in navigable waters. Michigan law makes it unlawful to remove minerals from under the Great Lakes without a lease from the Department of Natural Resources. The long-standing policy of the Department has been to refuse leases for mining operations that involve shafting or rigging. (Wilson-Florida)
W80-03759

THE FEDERAL RESERVED RIGHTS DOCTRINE - FROM 1866 THROUGH EAGLE COUNTY,
Debevoise and Liberman, Washington, DC.
J. C. Muys.
Natural Resources Lawyer, Vol 8, No 2, p 221-235, 1975.

Descriptors: *Federal-state water rights conflict, *Constitutional law, *Federal jurisdiction, Federal government, State governments, Navigable waters, Navigable rivers, Indian reservations, Non-navigable waters, Federal reservations, State jurisdictions.

Regulation of water usage in the western states has been hampered by a continuing competition between the federal and state governments. The federal government claims a power base in the constitutional grants of authority from the Welfare, War and Treaty Powers, and most importantly, from the Commerce and Property Clauses of the federal Constitution. The Supreme Court has held that the Commerce Clause vested control in Congress of all navigable waters, and has enlarged that power over the years to include even control over non-navigable streams which might affect navigable ones. Thus the federal government can prevent application of state laws to 'federal' waters. Further, the navigation servitude allows the federal government to take private property rights without compensation. Under the Property Clause, the argument is that the federal government still owns those lands in the western states which it has not specifically granted to the states, and thus retains the right to regulate water use on those lands. The development of case law on these subjects is traced, including a brief discussion of the Eagle County case, a 1971 decision on federal reserved rights. (Swanson-Florida).
W80-03777

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
R. Walston.
Hastings Law Journal, Vol 30, No 6, p 1645-1682, July 1979.

Descriptors: *California, *Federal-state water rights conflicts, *Water allocation(Policy), *Federal reclamation law, Water rights, History, Judicial decisions, Reclamation, California, Legislation, Federal government, Water law.

In many areas of law, the doctrine of federalism has been preempted by the increasing concentration of power at the national level. In water law, however, this trend has been reversed by the United States Supreme Court in California v. United States (the New Melones Dam decision). The original purpose of the 1902 Reclamation Act - in keeping with federalism - was to allow state control of water. This included the doctrine in western states and territories. As federal power expanded in this century, federal power over reclamation grew. The federal government possessed exclusive control of water stored behind federal dams. The New Melones Dam decision has stated that the states have a right to control the water in federal dams to the extent not inconsistent with specific congressional directives. The Court opted for the values of federalism. Uncertainty about the exact relationship of federal and state power can be overcome by giving presumptive correctness to state administrative policies for water allocation. (Wilson-Florida)
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
T. J. Beaton.
University of Colorado Law Review, Vol 50, No 2, p 207-229, Winter 1979.

Descriptors: *California, *Federal reclamation law, *Water allocation(Policy), *Federal-state water rights conflicts, Judicial decisions, Water rights, Irrigation, Reclamation, Legislation, Water law, Federal government.

One of the more controversial topics in Western water rights has been the relationship between federal and state policies regarding water usage. In California v. United States, the United States Supreme Court found that Section 8 of the 1902 Reclamation Act (Section 8) permitted California to impose conditions on Bureau of Reclamation water appropriation permits, if the conditions were not inconsistent with congressional directives regarding the water project. Section 8 provides that nothing shall be construed to interfere with any state laws relating to water appropriation. Previous decisions construing Section 8 have generally centered on a 'proprietary' theory of state involvement. This theory relegates state power under Section 8 to a minor role of merely defining the property interests involved. California v. United States rejects the proprietary theory and permits states to exercise control over the appropriation and distribution of water impounded by federal reclamation dams where not inconsistent with federal mandates. The issue is primarily one of Congressional intent, and could be easily clarified by Congress. (Wilson-Florida)
W80-03814

STATE CONTROL OVER FEDERAL RECLAMATION PROJECTS,
California State Water Resources Control Board, Sacramento.
W. R. Attwater.
Natural Resources Lawyer, Vol 8, No 2, p 281-295, 1975.

Descriptors: *California, *Federal-state water rights conflicts, *Judicial decisions, *Federal Reclamation Law, Reclamation, Water resources, Water allocation(Policy), State governments, Water law, Federal jurisdiction, State jurisdiction.

California and the United States (U.S.) Bureau of Reclamation have been locked in litigation regarding state authority over reclamation projects. The main issue involved is whether Section 8 of the 1902 Reclamation Act or any other federal law requires the U.S. to comply with state procedures regarding water appropriation when it seeks to acquire previously unappropriated water for project purposes. Although the Bureau's position is that it need not comply with state law regarding water appropriation, in the past, as a matter of comity, it has filed applications and participated in state administrative hearings. California law requires any person who wishes to appropriate water to apply for and receive a permit from the State Water Resources Control Board. Despite the literal language of Section 8 of the Reclamation Act, which preserves state law in reclamation, recent Supreme Court decisions have indicated other provisions of federal law may be overriding. Present reclamation procedures should be modified to meet the needs of both state and federal governments. Some modifications are suggested to the present procedure for authorization and construction of U.S. Bureau of Reclamation projects. (Wilson-Florida)
W80-03823

PIGOVIAN TAXES, POLLUTER SUBSIDIES, REGULATION, AND THE SIZE OF A POLLUTING INDUSTRY,
York Univ., Downsview (Ontario).
P. Burrows.
Canadian Journal of Economics, Vol 12, No 3, p 494-501, August, 1979. 2 Fig, 9 Ref.

Descriptors: *Pollution taxes(Charges), *Regulation, *Optimization, *Economic efficiency, *Size, Taxes, Economics, Curves, Costs, Demand, Industries, Damages, Marginal costs, Equations, Pollution abatement, Industrial wastes, Economic impact, Industrial production.

Pigovian taxes are not generally more efficient for society than other pollution control instruments and may not lead to Pareto-optimal industrial pollution levels. Either of two views may be correct, depending on damage cost curves of individual polluters: (1) Pigovian taxes may induce firms to leave industry when damages they cause do not justify this action. (2) If Pigovian taxes are set equal to marginal damage levels at Pareto-optimal pollution levels, industries will move toward their optimal pollution levels. If a large number of polluters exists in each locality, Pigovian tax leads to Pareto-optimal firm and industry output (pollution) levels; regulation does not reduce industrial pollution towards the Pareto-optimal level; and polluter subsidies perversely moves industrial pollution away from Pareto-optimization even though individual firms respond by cutting their output below Pareto-optimal levels. If small numbers of polluters exist in each locality or individual polluters face upward sloping marginal damage cost curves, Pigovian taxes are socially inefficient and too punitive while regulation/polluter subsidies are not punitive enough to induce Pareto-optimal exit of firms. Therefore, Pigovian taxes should not be used as a general standard of optimality against which to measure polluter subsidies and other polluter control instruments. (Danovich-Wisconsin)
W80-03848

FINANCIAL STATEMENT MODELING: ANALYZING THE POLLUTION-CONTROL TAX INCENTIVE,
For primary bibliographic entry see Field 6B.
W80-03850

CANADIAN-AMERICAN RELATIONS IN THE ARCTIC: THE EFFECT OF ENVIRONMENTAL INFLUENCES UPON TERRITORIAL CLAIMS,
T. M. Tynan.
The Review of Politics, Vol 41, No 3, p 402-427, July 1979.

Descriptors: *Canada, *Arctic, *United States, *International waters, *Political aspects, North America, International law, Treaties, Commercial fishing, Oil spills, Governments, Navigation, Disasters, Political constraints, Foreign waters, Northwest Passage(Canadian Arctic), Boundaries(Property).

Canadian foreign policy (1880-1970) concerning the Arctic has consistently been based upon a perception of potential threats to Canada's sovereignty and jurisdiction even when such threats never existed. A historical overview is presented to show how these perceptions may have developed. In terms of US-Canadian Arctic interactions, three phases can be discerned: (1) In the first or formative phase, Britain transferred her northern territories in the continent to Canadian control in 1880; from then until about 1940, Canadians were apprehensive that US population in these territories outnumbered those of Canadian citizenship. Canadians in fact only incrementally and tentatively exercized sovereignty rights over foreign economic interests in the territories. (2) The second phase, that of the Second World War and later construction of the Distant Early Warning (DEW) air defense facilities, was one of joint cooperation by the US and Canada; cooperation was partly due to the perception that a foreign threat, if any, came from Europe and Eurasia (Germany, then later, the USSR). (3) The most recent phase began in 1969 with the voyage through the Northwest Passage of the US oil tanker Manhattan. This event galvanized the Canadian government into enacting protective legislation for their Arctic lands, including pollution controls against the possibility of large-scale oil spills. These various historical patterns show Can-

ada's preoccupation with the immediate regional effects of events in the Arctic, regardless of the true thrust of US intentions in these regions. (Harris-Wisconsin)
W80-03852

ENVIRONMENTAL PROTECTION FOR WHOM,
Hampshire Coll., Amherst, MA. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W80-03853

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
D. Heath.
Annals of the American Academy of Political and Social Science, Vol 444, p 46-55, July 1979.

Descriptors: *Legislation, *Economics, *Costs, *Environmental control, Environment, Regulation, Benefits, Clean Air Act, Federal Water Pollution Control Act, Legal aspects, Environmental Protection Agency, Return(Monetary), Marginal return, Public health, Economic development, Control, Cost-benefit analysis, Income, Conservation, Governments.

Environmental laws of the United States specifically the Clean Air Act, Water Pollution Control Act, and Resource Conservation and Recovery Act, jeopardize the future well-being of its people. Overcontrol mandated or permitted by these laws is too costly even for an affluent society. Environmental over-control's high cost will cut deeply into family income over the next decade without providing any measurable improvement in health. In 1977, the U.S. spent $40 billion to comply with the three laws. By 1986, the total cost is expected to be $86 billion/yr (1977 dollars), more than double 1977 costs. In 1977, environmental laws cost each American family $600. By 1986 each family will be paying $1,300/yr (1977 dollars) to meet these laws. During 1977, clean-up costs were not critical and large gains were made at relatively low cost; but the law of diminishing returns, where small incremental improvements are very costly, is at work. Governmental overcontrol is evident in five areas: (1) standards based on studies of questionable values, (2) standards based on trivial health effects, (3) excessive safety margins, (4) widening list of pollutants deemed dangerous to health, and (5) arbitrary standards. (Danovich-Wisconsin)
W80-03857

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
C. Gopalakrishnan.
American Journal of Economics and Sociology, Vol 38, No 3, p 253-260, July 1979. 2 Tab, 9 Ref. JC-UH Sea Grant 7902.

Descriptors: *Oceans, *Developing countries, *Resources development, *Multinational corporations, *200 Mile exclusive economic zones, Governments, Economics, Law of the sea, Capital, Technology, Resource allocation, Resource management, Coasts, Oil, Legal aspects, Cooperation, Economic impact, Economic development, Exploitation, Natural resources.

Harmonization of the relationship between mulination corporations and nation-States will significantly increase because of a 200-mile exclusive economic shoreline zone in the world oceans. If coastal State's jurisdication extends 200 miles, a fact of international law about to receive juridicial status, a new regime of ocean resource use will emerge. This arrangement will most likely consist of a synergistic partnership of powerful nation-States and powerful multinational corporations, rather than overwhelming dominance and subjugation of one by another. From the perspective of resource use optimization and externalities, less-developed coastal states gain from enlisting the support of multinational corporations. Less developed coastal states lack key factors (capital, technology and managerial skill) necessary to tap oceanic resources. These marine technology factors exist primarily in the private sector. Multinational corporation activity generates new investment and employment opportunities, increases export earnings and improves balance-of-payments for these countries. Multinational corporations also derive numerous benefits, including high marginal capital efficiency and ready access to much-needed resources. What emerges is a unique situation of strong inter-dependence, where one party's strengths are automatically the other's weaknesses and vice-versa. (Danovich-Wisconsin)
W80-03859

LEGAL AND INSTITUTIONAL FACTORS AFFECTING MARICULTURE IN TEXAS,
Mc Glew and Brown, Austin, TX.
P. A. Mc Glew, and D. E. Brown.
Coastal Zone Management Journal, Vol 6, No 1, p 69-88, 1979.

Descriptors: *Texas, *Shellfish farming, *Aquatic animals, Water supply, Federal government, Shrimp, Bays, Dredging and filling, Waste disposal, Legal aspects.

Aquaculture is the technique of farming aquatic animals or plants. Mariculture includes what is popularly known as shrimp farming. Aquaculture and its specialized cousin, mariculture, provide some potential additional food sources and economic revenues. Technological barriers to increased mariculture production are being removed, but many legal and institutional barriers remain. Examples of the current and potential regulation of mariculture in Texas by state and federal authorities are examined. The effect of various state and federal regulations on the development of mariculture is discussed from a legal and institutional viewpoint. The potential for growth of mariculture is considered questionable without regulatory reforms, particularly at the federal level. Examined are the legal constraints in water supply, use of bay bottoms and the water column, dredging and filling operations, limited mariculture operations, waste disposal, taxation and financial aid, pesticides, and state authority over fisheries. The most significant problem facing new entrants into mariculture appears to be the indefiniteness of regulation. Recommendations are given that will remove some of the legal barriers to increased mariculture operations. (Corey-Florida)
W80-03873

WATER RESOURCE POLICIES AND AUTHORITIES: FEDERAL PARTICIPATION IN SHORE, HURRICANE, TIDAL AND LAKE FLOOD PROTECTION (FINAL RULE).
Corps. of Engineers, Washington, DC. Washington District.
Federal Register, Vol 44, No 15 p 4594-4603, January 22, 1979. 1 Tab, 1 App.

Descriptors: *Coastal plains, *Shore protection, *Flood protection, Beaches, Water resources, Cost sharing, Regulation, Federal government, Hazards, Hurricanes.

This regulation provides policies to United States Army Corps of Engineers Offices describing the extent of federal involvement in projects which provide shore, hurricane, tidal and lake flood protection. It is intended to update previous regulations to reflect recent changes in legislation and policy. This regulation makes reference to and provides a synopsis of the program legislation which it affects. The general program policy of the Corps is to undertake projects to prevent erosion and flooding of the coastal areas when those projects best serve the public interest. Special consideration is given to geographic applicability, coastal zone management plans, beach creation, shore categories, public use, and improvements for recreation. The role of the federal government is defined regarding pre-authorization studies, construction maintenance, periodic nourishment and work for other federal agencies. Cost sharing among federal and private concerns and the requirements for local cooperation are set forth. (Corey-Florida)
W80-03877

SALE AND LEASE OF INDIAN WATER RIGHTS,
B. Leaphart.
Public Land and Resources Law Digest, Vol 10, No 2, p 280-290, 1973.

Descriptors: *Indian reservations, *Water allocation(Policy), *Water resource development, Irrigation, Water resources, Federal government, Treaties, Rivers, Water law, Judicial decisions.

The leading case concerning Indian water rights is United States v. Winters, a 1908 Supreme Court decision. In stating that the water of the Milk River-the boundary of an Indian reservation could not be appropriated, the Court stated that the Indians had the entire use of the river's water rights. The 'Winters Doctrine' as developed by subsequent cases, has come to represent three basic propositions: (1) The priority date of a water right is the date the reservation is created, (2) The rights need not be exercised presently; and (3) The quantity of water to be enjoyed is measured by Indian needs, both present and future. In our industrialized nation, the concept of Indian 'need' should not be restricted to traditional agrarian purposes. The water reserved under the Winter's Doctrine should be open to the same development as other resources. As trustee for the Indians, the government should provide for the leasing of reserved waters for use of the Indian reservation. The sale and lease of water rights would enhance the reservation's economy. (Wilson-Florida)
W80-03880

OWNER ELIGIBILITY RESTRICTIONS - ACREAGE AND RESIDENCY,
Water and Power Resources Service, Sacramento, CA. Mid-Pacific Region.
C. R. Renda.
Natural Resources Lawyer, Vol 8, No 2, p 265-280, 1975.

Descriptors: *Federal Reclamation Law, *Water distribution(Applied), *California, Reclamation, Legislation, Federal jurisdiction, Water law, Water allocation(Policy), Legal aspects, Federal project policy, Administrative agencies.

Acreage and residency problems under reclamation law are not new. They have existed since the original 1902 Reclamation Act (Act). Current problems involving federal reclamation projects typically concern the development of private lands and the application of owner eligibility restrictions. Section 5 of the Act imposes a 160 acre limit for water rights from federal projects. These are referred to as 'non-excess lands'. However, the Bureau of Reclamation (Bureau) has permitted owners of larger tracts to make application for water covering all their lands subject to the condition that these 'excess lands' be subsequently transferred to an eligible person. Enforcement of these contractual promises is extremely difficult. Problems arise in regard to transfers to joint tenants, trusts, partnerships, corporations, and other legal arrangements. The Act also requires the participating landowner to be a bona fide resident or occupant of that land. The Bureau has not enforced this requirement since the 1926 Omnibus Adjustment Act. A United States District Court held in 1972 that the restriction is required by the Act, as a continuing restriction upon the right to receive project water. As of this article, that decision was on appeal. (Wilson-Florida).
W80-03883

SPATIAL ASPECTS OF THE PRESSURE FOR SHORELINE DEVELOPMENT: THE EXAMPLE OF PUGET SOUND,
Ottawa Univ. (Ontario). Dept. of Geography and Regional Planning.
P. Harrison.
Coastal Zone Management Journal, Vol 2, No 2, p 125-148, 1975.

Descriptors: *Washington, *Spatial distribution, *Water management(Applied), Coasts, Management, Legislation, Urbanization, Developed waters, Water law, Water resources development, Shores.

When environmental legislation is enacted, the nature and spatial structure of the resulting management area are rarely considered in any detail. Several specific variables create different spatial pressures on the use of salt water shorelines. Population growth, urbanization, employment structure, and personal income in the Puget Sound region of Washington are analyzed. The bulk of population, wealth, and economic activity in Washington state is in the Puget Sound area. The Seattle-Tacoma metropolitan area is the source of much pressure for further shoreline development. The spatial expression of this development is analyzed in two contexts: (1) 'Spread' development or low density use spread in a line along the shoreline; and (2) 'Nucleated' development involves the use of less shoreline, but with higher density of use. Through 'spatial dominance' the more affluent areas affect and control economic development. Recent shoreline management legislation completely ignores those spatial phenomena. The burden of shorelines management is placed upon local authorities. Ironically, poorer rural counties then must provide for the spillover and domination effect of the more affluent municipality areas. Giving counties the initiative in shoreline management is no guarantee that differential spacial structure will be taken into account. (Wilson-Florida).
W80-03884

WILL JUDICIAL ERROR ALLOW INDUSTRIAL POINT SOURCES TO AVOID BPT AND PERHAPS BAT LATER. A STORY OF GOOD INTENTIONS, BAD DICTUM, AND UGLY CONSEQUENCES,
Weston, Hurd, Fallon, Paisley, and Howley, Cleveland, OH.
J. S. Kalur.
Ecology Law Quarterly, Vol 7, No 4, p 955-988, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Water pollution control, Regulation, Legislation, Effluents, Industrial wastes, Judicial decisions, Water pollution sources, Water law, Administrative agencies.

Section 301 (6) of the Federal Water Pollution Control Act Amendment (FWPCA) is the heart of a plan to reduce or eliminate water pollution discharges from point sources. By July 1, 1977, all dischargers were to have achieved compliance with designated effluent limitations via installation of the 'best practicable technology' (BPT) at all point sources. To fill the expected period between passage of the FWCPA and establishment of limitations, an interim permit program was created by section 402 (a) (1) which allowed lawful discharge prior to the adoption of BPT. The Federal Environmental Protection Agency has generally failed to include provisions to assume BPT compliance in the interim permits. Since most permits were issued for five years, a postponement of compliance was approved by the Supreme Court in du Pont v. Train. The intent of Congress was to require uniformity in water pollution control. The failure of industrial point sources to meet BPT limitations by the deadline has thwarted this plan. (Wilson-Florida)
W80-03885

'ONE PERSON, ONE VOTE' AND CALIFORNIA'S WATER DISTRICTS,
Auburn Univ., AL.
D. L. Martin.
Natural Resources Lawyer, Vol 8, No 1, p 9-28, 1975.

Descriptors: *California, *Water districts, *Constitutional law, Judicial decisions, State government, Water law, Legal aspects, Public utilities, Irrigation, Districts, Decision making water policy.

Special districts performing water utility operations in California have a variety of enabling acts to which reapportionment challenges have been raised in the courts. Some elect their directors on a resident voting basis. Others restrict the franchise to landowners, with votes proportioned to the number of acres held or according to assessed valuation. The legal challenges over existing voting arrangements are fundamentally a struggle for control over vast economic resources. The issue has been whether the 'one person, one vote' finding of the reapportionment revolution of the 1960's should be extended to water districts. The judicial analysis has traditionally been in terms of whether the principal purpose of the special water district was to provide services without exercising the general powers of government. In 1973, the United States Supreme Court declined to intervene in the voting arrangements of a water storage district. The majority held that the district provided none of the general public services attributed to a governing body. The courts face future challenges in defining the applicability of the Equal Protection Clause to quasi-public utility districts. (Wilson-Florida)
W80-03886

THE CONVENTION FOR THE PREVENTION OF MARINE POLLUTION FROM LAND-BASED SOURCES: AN EFFECTIVE METHOD FOR ARBITRATING INTERNATIONAL EFFLUENT POLLUTION DISPUTES,
R. H. Busby.
California Western International Law Journal, Vol 5, No 2, p 350-375, Spring 1975.

Descriptors: *Water pollution control, *International commissions, *International law, Effluents, Coasts, Pollutants, Water law, Water pollution, Oceans, Legal aspects.

Effluent pollution, broadly defined as the flow of waste materials into rivers and coastal seas, has reached alarming proportions. This pollution is produced primarily by man's land-based industrial activities. Effluent pollution occurs mainly in the coastal waters. Arbitration, diplomacy, and litigation are among the methods available to the international community to control and combat this form of marine pollution. Diplomatic channels have drawbacks which prohibit their effective use against pollution: (1) lack of speed and directness; (2) national interests; and (3) suspicion by lesser developed nations of economic coercion. Litigation is hindered in its effectiveness by problems with jurisdiction, determining the proper party to bring the action, and appropriate theories of liability. International arbitration has been effectively employed as a means to settle disputes. Submission of a conflict to arbitration minimizes political maneuvering and permits concentration on the merits of the controversy. The Convention for the Prevention of Marine Pollution from Land-Based Sources, utilizing arbitration, presents guidelines for a comprehensive, regionally organized effort at pollution control. The waters in which its provisions apply are multi-national. Its flexibility and potential speed of action make it an important tool against pollution. (Wilson-Florida)
W80-03887

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
For primary bibliographic entry see Field 3F.
W80-03888

MARINE RESOURCES COMMITTEE-ANNUAL REVIEW OF SIGNIFICANT LEGISLATIVE, JUDICIAL AND ADMINISTRATIVE ACTIVITIES DURING 1977.
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 11, No 1, p 76-97, 1978.

Descriptors: *Marine fisheries, *Shore protection, *Water pollution control, Legislation, Judicial decisions, Administrative decisions, International commissions, Fisheries, Mining, Federal government, Oceans.

A review of legal activity related to United States offshore seabed resources, reveals: (1) Two bills were introduced in Congress to amend the Outer Continental Shelf Lands Act, but were not enacted; (2) the Secretary of the Interior established a new policy for lease sales. Concerning deepwater ports, the Secretary of Transportation issued several licenses with some new modifications of the conditions contained in the forms of license. Regarding coastal zone management, regulations written by the Office of Coastal Zone Management to implement the Coastal Energy Impact Program come under frequent attack in Congress. Coastal zone management plans in Oregon and California were approved. The most significant activity in the fisheries area was the implementation of the Fishing and Conservation Act. As to deep seabed hard minerals, the United Nations Conference on the Law of the Sea issued an 'Informal Composite Negotiating Text'. Congress considered legislation to regulate high seas mining by American ships. Regarding the preservation of the marine environment, several states passed comprehensive oil spill liability laws. The federal courts upheld several pollution statutes. Voluntary pollution liability agreements are discussed. President Carter submitted proposed new rules, regarding the transportation of marine resources, under the authority of the 1972 Ports and Waterways Safety Act. These are applicable to all ships trading to United States ports. (Wilson-Florida)
W80-03889

6F. Nonstructural Alternatives

EMPLOYMENT IN THE FISHING INDUSTRY: SOME PRELIMINARY FINDINGS ON FISHERMEN'S MOBILITY,
C. L. Yap.
The Developing Economies, Vol 16, No 3, p 283-297, September, 1978. 13 Tab, 12 Ref.

Descriptors: *Commercial fishing, *Social mobility, *Malaysia, *Labor supply, Fisheries, Employment, Employment opportunities, *Social aspects, Social needs, Trawling, Income, Labor, Labor mobility, Size, Education.

large numbers of children per family, their low education and training level, and their occupational immobility are the main reasons for a cycle of overmanned fishing boats and individual underemployment in Malaysia. Money, used to subsidize fishery expansion in waters already overfished, is better utilized by training and equipping young people less entrenched in the traditional social setup to take on other occupations. Alternatively, incentives may be provided to the private sector to locate their manufacturing plants and business enterprises near fishing communities. Social dislocation may be less than that experienced by an individual exercising his own initiative. Malay peasant fishermen have an extended family system in which it is socially unacceptable to exclude a relative or friend who is unemployed from sharing in a catch. Fisherman remuneration is by profit sharing. When the trawl net was adopted in 1965, many people took up fishing, leading to overfishing and extreme employment fluctuations. A study in findings, one of the most important fishing districts in Peninsular Malaysia, show that 78% of the fishermen are intra-district movers and only 22% are inter-district/state movers. The ratio of child movers to parents varies 0.4-0.7:1, indicating low mobility. Mean average number in a family is 6-7. Only 82.4% of fishermen have attended primary schools and 0% have received secondary schooling. (Danovich-Wisconsin)
W80-03856

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
For primary bibliographic entry see Field 6E.
W80-03859

6G. Ecologic Impact Of Water Development

EMPLOYMENT IN THE FISHING INDUSTRY: SOME PRELIMINARY FINDINGS ON FISHERMEN'S MOBILITY,
For primary bibliographic entry see Field 6F.
W80-03856

7. RESOURCES DATA

7B. Data Acquisition

INSTRUMENTATION OF URBAN HYDROLOGY MONITORING SITES IN SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Hardee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123417, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-37, July 1979. 38 p, 23 Fig, 9 Ref.

Descriptors: *Instrumentation, *Urban hydrology, *Florida, *Data collections, *Monitoring, Sites, Sampling, Rainfall, Urban runoff, Storm runoff, Storm drains, Water quality, Measurement, Logging(Recording), Analog models, Venturi flumes, *U-shaped constriction, *Stilling well, *Electromagnetic velocity meter, Southeast Florida.

An instrumentation system developed and built in laboratories of the U.S. Geological Survey, Reston, Va., has been used since 1974 to collect synchronized rainfall, runoff, and water-quality data from urban basins. A number of field modifications were made to adapt the system to local hydrologic conditions and for collection of data on about 350 rainstorms at four sites in south Florida. The instrumentation system measures rainfall at three sites, records two pressure or water-level readings for flow computations, and collects and refrigerates up to 24 water samples and rainfall-quality samples. Rainfall and runoff data are recorded every 36 seconds on a six-channel analog recorder so that all variables are time-synchronous. Flow in the storm sewer is computed from pressure measurements in a U-shaped venturi-type constriction or, when the constriction is not used, from water levels. (Kosco-USGS)
W80-03766

7C. Evaluation, Processing and Publication

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
W. M. Brown, III.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 84-100, 1978. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Water quality, *Erosion, *River basins, *Oregon, Watersheds(Basins), Synoptic analysis, Planning, Sedimentation, Mapping, Environment, Analytical techniques, Soil erosion, Land use, Precipitation(Atmospheric), Runoff, Vegetation, Soils, Deposition(Sediments), Aerial photography, Methodology, Topography, *Willamette River Basin(OR), Matrix methods.

A synoptic approach was devised to delineate the relationships that exist between physiographic factors, land-use activities, and resultant erosional problems. The approach involves the development of an erosional-depositional province map and a numerical impact matrix for rating the potential for erosional problems. The province map is prepared by collating data on the natural terrain factors that exert the dominant controls on erosion and deposition in each basin. In addition, existing erosional and depositional features are identified and mapped from color-infrared, high-altitude aerial imagery. The axes of the impact matrix are composed of weighting values for the terrain factors used in developing the map and by a second set of values for the prevalent land-use activities. The body of the matrix is composed of composite erosional impact ratings resulting from the product of the factor sets. Together the province map and problem matrix serve as practical tools for estimating the erosional impact of human activities on different types of terrain. The approach has been applied to the Willamette River basin, Oregon, and has proven useful for the recognition of problem areas. The erosional potential map and matrix are useful tools for (1) immediate land-use planning, (2) the selection and monitoring of best management practices, and (3) the design of data collection programs to assess land and river quality. For all three purposes, the tools are flexible, because through interpretation of aerial photography, they can be regularly updated to provide information under rapidly changing conditions. (See also W80-03606) (Humphreys-ISWS)
W80-03613

HYDRAULICS OF FLOW IN THE KASKASKIA RIVER, ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-03713

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
Bulletin 230-78, July 1978. 321 p, 5 Tab.

Descriptors: *Hydrologic data, *Data collections, *California, *Stations, Information retrieval, Surface waters, Water quality, Groundwater, Groundwater resources, Gaging stations, Drainage area, Water levels, Wells, Well data.

This first edition of 'Index to Sources of Hydrologic Data' comprises four independent sections: an index to surface water measurement stations, an index to surface water quality stations, an inventory of groundwater wells and data, and a list of current publications on climatological data. Initiation of this new periodic series as a reference publication replaces the Department's series of data publications, 'Hydrologic Data'. Bulletin 230 represents a fundamental change: rather than reporting the data, it provides both a summary of sources from which the data may be obtained and the Water Data Information System (WDIS). WDIS is a computer-based system that presently manages surface water quality data, groundwater level measurements, and groundwater quality data. This means that data of these disciplines can be retrieved or evaluated by using a common group of record identification fields. Among these are Hydrographic Areal Designation, Station Number, Date and Time (of observation), and County. Other fields--or addresses--not yet common to all the disciplines are Latitude and Longitude and the U.S. Public Land Survey (Township, Range, and Section). Data are presently entered, stored, and retrieved at the Department's computer center in Sacramento. Data in the water quality disciplines are summarized under six parameter groups: minerals, nutrients, minor elements, supplemental minor elements, miscellaneous, and pesticides. WDIS has about 120 electronic data processing programs written to store, retrieve, evaluate, and print out data for water quality and groundwater level measurements. (Humphreys-ISWS)
W80-03744

WATER RESOURCES DATA FOR INDIANA, WATER YEAR 1978.
Geological Survey, Indianapolis, IN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144355, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IN-78-1, September 1979. 383 p, 4 Fig, 3 Tab.

Descriptors: *Indiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 194 gaging stations, stage and contents for 13 lakes and reservoirs, water quality for 49 gaging stations, and water levels for 59 observation wells. Also included are 124 crest-stage partial-record stations and 49 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Indiana. (Kosco-USGS)
W80-03752

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1978.
Geological Survey, Anchorage, AL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143910, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AK-78-1, November 1979. 425 p, 4 Fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 117 gaging stations, stage only records for 2 gaging stations, water quality for 64 stations, and water levels for 28 observation wells. Also included are 79 low-flow, 87 crest-stage, and 24 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (Kosco-USGS)
W80-03753

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124662, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3A-1, September 1979. 272 p, 10 Fig, 1 Tab.

Descriptors: *Florida, *Hydrologic data, *Surface waters, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Water levels, Data collections, Sites, Southwest Florida, *Lake elevations.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes discharge records for 70 streams, stage-only records for 24 streams, elevations for 110 lakes, miscellaneous measurements, and crest-stage partial records for 12 streams. These data represent the

National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03754

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-2. SOUTHWEST FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126386, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3A-2, September 1979. 614 p, 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, Southwest Florida.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes water quality data for approximately 245 surface water sites. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03755

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3B. SOUTHWEST FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126394, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3B, September 1979. 616 p, 19 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Groundwater, *Water quality, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Southwest Florida.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes periodic water level measurements for 450 wells and water quality data for approximately 300 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03756

SURFACE-WATER FEATURES IN OSCEOLA COUNTY AND ADJACENT AREAS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. H. Hughes, and J. M. Frazee, Jr.
Geological Survey open-file report 79-1289 (WRI), 1979. 1 Sheet, 11 Fig, 3 Tab, 4 Ref.

Descriptors: *Surface waters, *Hydrologic properties, *Florida, *Water quality, *Lakes, Basins, Streams, Streamflow, Drainage, Rainfall, Evapotranspiration, Evaporation, Gaging stations, Sampling, Sites, Hydrologic data, Chemical analysis, Maps, *Osceola County(Fla).

The western two-thirds of Osceola County, Fla., drains southward by way of the Kissimmee River and its tributaries; the eastern one-third drains eastward to the St. Johns River or to marshy areas that make up part of the headwaters of the St. Johns River. About 15 percent of the county is covered by several hundred lakes whose surface areas range in size from a few to several thousand acres. Much of the natural drainage has been altered by canalization or regulated by control structures. Under natural conditions streamflow is seasonal, usually high in September or October and low in May or June, in phase with the rainy season. Control structures are used to maintain lake levels within a relatively small range in stage, producing greater seasonal variations in river flow than before regulation. Dissolved-solids concentration of much of the surface water is less than 240 mg/l, in some, much less. The water typically is of calcium bicarbonate type. Color is fairly high, in water draining from swamps, where the pickup of humic acids is significant. (Kosco-USGS)
W80-03761

PLACES IN CONNECTICUT WHERE GROUND WATER IS KNOWN TO HAVE DETERIORATED IN QUALITY,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, I. G. Grossman, R. S. Potterton, Jr., and E. H. Handman.
Available from: USGS 1200 S. Eads St. Arlington, VA price. 75. Geological Survey, Miscellaneous Field Studies Map MF-981-G, 1979. 1 Sheet, 2 Ref.

Descriptors: *Maps, *Connecticut, *Groundwater, *Water pollution sources, *Water quality control, Water analysis, Aquifers, Water wells, Path of pollutants, Saline water intrusion, Coasts.

A map of Connecticut, scale 1:125,000, shows locations of wells known to have produced contaminated water and their relation to favorable aquifers. About 450 wells are included. The map also delineates the coastal area vulnerable to saltwater intrusion. (Kosco-USGS)
W80-03762

SELECTED WATER RESOURCES DATA, CLARION RIVER AND RED-BANK CREEK BASINS, NORTHWESTERN PENNSYLVANIA--PART 2,
Geological Survey, Pittsburgh, PA. Water Resources Div.
T. F. Buckwalter, C. H. Dodge, and G. R. Schiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104915, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-19, July 1979. 135 p, 51 Fig, 8 Tab, 8 Ref.

Descriptors: *Hydrologic data, *Groundwater resources, *River basins, *Pennsylvania, *Basic data collections, *Water quality, Surface waters, Aquifers, Water levels, Water yields, Water wells, Springs, Chemical analysis, Sampling, Sites, Water analysis, Trace elements, Aquatic insects, *Northwestern Pennsylvania, Clarion River Basin(Pa), Redbank Creek Basin(Pa).

This report presents selected basic data collected during a study of the water resources of the Clarion River and Redbank Creek basins in northwestern Pennsylvania. Hydrologic information including data on aquifers, water levels, and yields is presented for 1,304 wells. Records for 51 springs are also given. The report contains 83 chemical analyses of water samples collected from 30 stream sites and 300 analyses of water from 196 wells and 43 springs. Also included are 103 trace-element analyses. Monthly and annual means of groundwater levels for six observation wells are tabulated. Benthic invertebrate data from 136 stream sites are listed. Locations of data-collection sites are shown on 50 page-size reductions of 7.5-minute topographic quadrangle maps. (Kosco-USGS)
W80-03770

SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT FOR 1978,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. L. Knutilla, and H. C. Rollins.
Available from: OFSS Bx 25425 Fed. Ctr. Denver, CO paper copy 16. microfiche $3.50. Geological Survey open-file report 79-1257, 1979. 118 p, 35 Fig, 3 Tab, 6 Ref.

Descriptors: *Water resources, *Projects, *Publications, *Abstracts, *Bibliographies, Groundwater, Surface waters, Water quality, Streamflow, Water supply, Water utilization, Water resources development, Reviews, Florida, *Southwest Florida.

This report summarizes water-resources investigations in the Southwest Florida Water Management District performed by the U.S. Geological Survey, Water Resources Division, for fiscal year 1978. The investigations are part of the Federal program of appraising the nation's water resources. The cooperative program for fiscal year 1978 included 37 interpretive investigations. Abstracts of 30 reports released during 1978 and a bibliography of reports released since 1933 are included. The hydrologic setting of southwest Florida and discussions of surface-water, ground-water, and quality-of-water conditions are given. Hydrologic conditions in southwest Florida are described and illustrated by hydrographs of selected surface-water, ground-water and lake-stage data collection sites. In addition, summaries of water-use data and data on the regional observation monitor-well program are provided. (Kosco-USGS)
W80-03771

INTERPRETATION OF UNENHANCED LANDSAT IMAGERY FOR WETLAND AND LAND USE DELINEATION IN THE TEXAS COASTAL ZONE,
Texas Univ. at Austin. Bureau of Economic Geology.
R. J. Finley.
Transactions--Gulf Coast Association of Geological Societies, Vol 26, p 279-297, 1976. 14 Fig, 4 Tab, 16 Ref.

Descriptors: *Wetlands, *Texas, *Remote sensing, *Terrain analysis, Coastal marshes, Mapping, Land use, Satellites(Artificial), Distribution patterns, Maps.

LANDSAT imagery was used in a procedure dependent on optical enlargement of part of a band 7 1:1,000,000 image to fit an existing 1:250,000 map base. Land-water and other boundaries were placed on an overlay on which unit boundary data was interpreted from both other bands and the false-color composite of bands 4, 5, and 7. Each resulting map unit was then classified according to a bi-level classification scheme. Level I classes include urban areas, agricultural land, grassland, woodland, water, wetlands, and barren lands. Twenty-three Level II categories included five wetland classes: topographically low marshes, topographically high marshes, tidal flat, grass and algal flats, and vegetated spoil. Water was separated into four Level II classes on the basis of turbidity. Comparison of the LANDSAT maps with aerial photography, published maps, and field data has shown that the Level II category delineation limits are primarily dependent on size of the map unit relative to LANDSAT's resolution limits and on reflectivity contrast with surrounding units. Other factors influencing accuracy include homogeneity of the map unit, spatial position with respect to surrounding units, season of the year in which imagery was taken, and image quality. (Steiner-Mass)
W80-03878

8. ENGINEERING WORKS

8B. Hydraulics

FORMULATING LAKE MODELS WHICH PRESERVE SPECTRAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-03605

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
For primary bibliographic entry see Field 2E.
W80-03619

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
C. B. George, and J. F. A. Sleath.
Journal of Hydraulic Research, Vol 17, No 4, p 304-313, 1979. 10 Fig, 8 Ref.

Descriptors: *Steady flow, *Velocity, *Flow, Roughness(Hydraulic), Roughness coefficient, Hydraulics, Anemometers, Currents(Water), Waves(Water), Sediment transport, Equations, Open channel flow, Laboratory tests, Analytical techniques, Analysis, Model studies, *Oscillatory flow, Rough bed.

Measurements are described of the fluid velocities close to a rough bed oscillating in its own plane in a chamber with superimposed mean drift. The measurements were made in air with a hot-wire anemometer. It was found that over a wide range of conditions the common assumption that the combined flow may be treated as the vector sum of the steady and oscillatory flows separately is incorrect. In all cases investigated, the drift near the bed was less than that which would have been expected in the absence of non-linear interaction between the oscillatory and steady flows. For certain conditions the drift near the bed was actually in the opposite direction to that of the superimposed flow. (Lee-ISWS)
W80-03620

OBSERVATIONS OF STRATIFIED FLOW PAST THREE-DIMENSIONAL BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
P. G. Baines.
Journal of Geophysical Research, Vol 84, No C12, p 7834-7838, December 20, 1979. 7 Fig, 7 Ref. NSF OCE78-19833.

Descriptors: *Flow, *Flow around objects, *Laboratory tests, Flumes, Hydraulic models, Model studies, Fluid mechanics, Barriers, Stratified flow, Hydraulics, Hydrology.

Experiments on stratified flow at large Reynolds numbers over barriers with gaps, towed along the bottom of a long tank, were described. The primary purpose of the observations was to determine the circumstances under which fluid flows over the barrier or is deflected horizontally around the barrier through the gap. A range of gap widths (including zero) was used, and the barrier had 'Witch of Agnesi' profile with height about half width. For the two-dimensional barrier (i.e., zero gap), blocked fluid was observed upstream if F = U/Nh was less than 0.5. For the same barrier with a gap, if F was less than 0.5, all the fluid incident below a certain height z sub s(less than h) flowed around the barrier through the gap; above this height the fluid flowed over the barrier in nearly two-dimensional fashion. The parameter z sub s was a function of both F and gap width. For F greater than 0.5 all (or almost all) of the fluid incident on the barrier flowed over it, and the motion was predominantly two dimensional in the vertical plane. (Sims-ISWS)
W80-03624

FLOW VISUALIZATION IN COMPLEX TURBULENT FLOWS,
Chiap Hua Comalco Ltd., Kowloon (Hong Kong).
L. H. Y. Lee, and J. A. Clark.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15209, p 247-268, February 1980. 14 Fig, 2 Tab, 37 Ref, 1 Append.

Descriptors: *Turbulence, *Boundary layers, *Flow separation, *Shear, Model studies, Hydraulic models, Flumes, Jets, Injection, Flow, Turbulent flow, Flow friction, Transition flow, Viscosity, Bubbles, Entrainment, Hydrodynamics, Hydraulics, *Flow visualization, Vortices.

Angled injection of submerged laminar plane jets into a turbulent boundary layer developed along a vertical wall of a large recirculating water channel was visualized. The mixing layers associated with the jet and their interaction with the boundary layer and resulting transition mechanisms in the generation of turbulence were described. A recirculation bubble region related to separation was revealed, and primary systematic transverse vortex structures formed in the outer mixing layer of the jet were characterized. A physical model was proposed which describes the initiation, the formation, and the coalescence of vortices as part of a transition process in the development of turbulence. (Sims-ISWS)
W80-03715

DAMPING OF GRAVITY WAVES OVER POROUS BED,
Maine Univ. at Orono. Dept. of Mathematics.
K. K. Puri.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15214, p 303-312, February 1980. 2 Fig, 10 Ref, 3 Append.

Descriptors: *Gravity waves, *Viscous flow, *Beds, *Model studies, Mathematical models, Porous media, Porosity, Permeability, Channels, Flow, Hydrodynamics, Hydraulics, *Wave damping.

The damping of gravity waves over the contaminated free surface of a viscous layer of fluid that is bounded below by a porous bed was investigated. It was assumed that the bed is saturated with the same fluid. The coupled system of linearized equations appropriate to the fluid layer and the porous bed was solved to study the damping of a progressive wave on the surface of the fluid. The dispersion relation yielding the dependence of the frequency on the viscosity on the parameters related to the porous bed, and on the free surface film, was derived. The effect of the latter on the damping of the waves was found to be very significant. The results obtained subsumed the hitherto known results of other authors. (Sims-ISWS)
W80-03716

STAGED MULTIPORT DIFFUSERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-03717

HYDRAULICS OF RECTANGULAR VERTICAL DROP STRUCTURES,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-03739

AIR BUBBLES IN A CONVECTIVELY ACCELERATED WATER FLOW,
Khartoum Univ. (Sudan). Dept. of Civil Engineering.
A. M. A. Salih.
Journal of Hydraulic Research, Vol 17, No 4, p 315-327, 1979. 6 Fig, 1 Tab, 21 Ref.

Descriptors: *Bubbles, *Flow, *Laboratory tests, *Mathematical models, Model studies, Velocity, Movement, Settling velocity, Instrumentation, Photography, Hydraulics, Civil engineering.

The motion of injected air bubbles of equivalent diameters between 0.98 mm to 6.25 mm was experimentally studied using photographic recordings. The theoretical analysis formulated for this study showed that the relative velocity of the air bubbles approached a state similar to the terminal velocity in still water shortly after being subjected to acceleration. Experimental results conclusively proved that the theoretical approach and formulae were developed to express these experimental findings in accordance with the theoretical and statistical approaches. (Sims-ISWS)
W80-03740

HYDRAULICS OF A LARGE CHANNEL PAVED WITH BOULDERS,
Ministry of Works and Development, Wellington (New Zealand). Power Div.
For primary bibliographic entry see Field 2E.
W80-03741

8E. Rock Mechanics and Geology

PREPARATION OF FRIABLE AQUIFEROUS SPECIMENS,
Humphreys (Howard) and Partners, Reading (England).
P. F. Worthington.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Technical Note, p 333-337, February 1980. 2 Fig, 7 Ref, 1 Append.

Descriptors: *Aquifers, *Sampling, *Porous media, *Methodology, Castings, Aquifer characteristics, Testing procedures, Permeameters, Limestones, Groundwater, Sandstones, Protection, Friable specimens.

This note described the procedure adopted for the preparation of friable limestone and sandstone specimens of markedly variable lithology taken from the post-Cretaceous succession of the Kalahari Basin. Preliminary trials with sample fragments demonstrated that their indiscriminate saturation under a vacuum resulted in disintegration. Thus, it was essential that the cubic specimens be cast in a retaining medium before any attempt at saturation. All casting was carried out at room temperature using a commercial liquid, solvent-free epoxy resin (specific gravity 1.15) together with a liquid hardener (specific gravity 1.0) mixed in the ratio 10:1 by weight, and possessing the properties of negligible cure shrinkage, high heat resistance, very low water absorption, and high electrical resistivity. The measurement of intergranular permeability required that each mounted specimen be fixed into a cell. This proposed method for the preparation of friable specimens for petrophysical measurement has several distinct advantages. With the exception of the invaded zones, the specimen is preserved in the same state as in the original core sample. No loss of specimens has been suffered either by disintegration during saturation, flushing and drying, or through uncontrolled contamination by the casting mixture. The specimen is fully protected against accidental damage by the mounting fixture which has proved to be extremely durable. Futhermore, the proposed procedure for the preparation of specimens does not physically impede the subsequent petrophysical investigations. (Humphreys-ISWS)
W80-03719

8I. Fisheries Engineering

A BIOECONOMIC MODEL OF THE GULF OF MEXICO SHRIMP FISHERY,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
W. E. Grant, and W. L. Griffin.
Transactions of the American Fisheries Society, Vol 108, No 1, p 1-13, January, 1979. 6 Fig, 5 Tab, 22 Ref. 04-6-158-44108.

Descriptors: *Model studies, *Galveston Bay, Texas, *Commercial fishing, *Shrimp, *Economics, Simulation analysis, Coasts, Bays, Fisheries, Shellfish, Gulf of Mexico, Commercial shellfish, Harvesting, Seasonal, Management, Depth, Rent, Size, Distribution, Income.

A bioeconomic simulation model of the Gulf of Mexico shrimp industry is capable of assessing impacts of alternative management strategies on shrimp harvests. The model accurately predicts general trends in shrimp harvest seasonality and

distribution in relation to shrimp size and water depth. Simulations were confined to the brown shrimp (Penaeus aztecus) fishery in Galveston Bay, Texas and adjacent offshore waters. The model predicts 2.31 million kg (heads-off weight) annual harvest, 1963-1971, while actual data indicate a 2.22 million kg annual harvest during this period. Almost 80% of the harvest is composed of shrimp in 44-66 and 67-110 tails/kg size classes. Total weight of each size class landed generally increases from the bay to successively deeper offshore areas. The harvest is highly seasonal; 94% of landings occurs May-October. Gross fishery revenue is $41 million and annual rent is $4.2 million. Model results imply that some management alternatives such as doubling nominal days fished may increase total harvest; however, marginal fishing costs increase at a relatively higher rate, reducing rent to the fishery. Sensitivity analysis emphasizes the need for better information on shrimp growth and natural mortality and on the proportion of the population which is actually subjected to fishing pressure. (Danovich-Wisconsin)
W80-03845

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For primary bibliographic entry see Field 6F.
W80-03856

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Illinois State Water Survey, Hydrology	W80-03605--03609 03611--03638 03713--03744 03836--03837 03839	68
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University of Wisconsin, Eutrophication	W8U-03782--03794 03796--03813 03815--03822 03824--03834 03890--03894 03900	56
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VOLUME 13, NUMBER 12
JUNE 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
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VOLUME 13, NUMBER 12
JUNE 15, 1980

W80-03901 -- W80-04200

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

GROUND WATER INTERACTIONS WITH WETLANDS,
Lowell Univ., MA. Dept. of Earth Sciences.
A. L. O'Brien.
Well Log, Vol 10, No 11, p 49-50, December, 1979. 6 Ref. OWRT-B-012-MASS(9).

Descriptors: *Wetlands, *Massachusetts, Swamps, *Ground water, Subsurface waters, Aquifers, *Aquifer characteristics, *Discharge, Effluent streams, *Groundwater movement, *Groundwater recharge, Surface-groundwater relationships, Water table.

Wetlands in Massachusetts commonly occur in association with potential aquifers: stratified drift, lake bottom deposits, and alluvium. The relationship of wetlands to ground-water and the underlying deposit is shown by a water budget analysis of a wetland in eastern Massachusetts. Monitoring showed a close coupling between ground-water and the stream which resulted in rapid ground-water discharge during flood events. In fact, 93% of the total annual discharge was due to ground-water. This rapid ground-water discharge from a shallow upper layer of the ground-water body resulted in high spring discharges and little low flow augmentation in the summer. Such patterns of discharge should be considered whenever ground-water is developed from wetland associated aquifers.
W80-03926

DESIGN OF OPERATIONAL PRECIPITATION AND STREAMFLOW NETWORKS FOR RIVER FORECASTING,
GKY and Associates, Inc., Alexandria, VA.
For primary bibliographic entry see Field 7A.
W80-03939

SAMPLING OF INTERRELATED RANDOM FIELDS: THE RAINFALL-RUNOFF CASE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7A.
W80-03940

SOIL SPATIAL VARIABILITY AND ITS CONSEQUENCES ON SIMULATED WATER BALANCE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2G.
W80-03947

CLIMATOLOGICAL ESTIMATE OF THE AVERAGE MONTHLY ENERGY AND WATER BUDGETS OF LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2H.
W80-03953

DISCHARGE RESPONSE ANALYSIS AND HYDROLOGIC SIMILARITY: THE INTERRELATION BETWEEN THE GEOMORPHOLOGIC IUH AND THE STORM CHARACTERISTICS,
Universidad Simon Bolivar, Caracas (Venezuela).
I. Rodriguez-Iturbe, G. Devoto, and J. B. Valdes.
Water Resources Research, Vol 15, No 6, p 1435-1444, December 1979. 14 Fig, 4 Tab, 11 Ref.

Descriptors: *Watersheds(Basins), *Rainfall, *Runoff, *Model studies, Mathematical models, Hydraulic similitude, Geomorphology, Discharge(Water), Streamflow, Dynamic programming, Storms, Storm runoff, Drainage, Hydrographs, Unit hydrographs, Synthetic hydrology, Hydrology, Hydrologic similarity, Geomorphic structure, Hydrologic response.

It was shown that the dynamic parameter nu of the geomorphologic instantaneous unit hydrograph (IUH) can be taken as the velocity at the peak discharge time for a given rainfall-runoff event in a basin. This transforms the time variant IUH throughout the event into a time invariant IUH in each storm occurrence. The errors which the a priori estimation of the velocity in the IUH may cause in the calculation of the peak and time to peak of the runoff discharge were estimated for different types of basins and storms; the relative weights of the storm characteristics and the drainage network parameters in the prediction procedure were also studied in detail. Drainage basins were defined as hydrologically similar if they have the same IUH when kinematic conditions were kept the same; through the geomorphologic IUH theory it was shown that the controlling parameter in hydrologic similarity is (R sub L) to the 0.43 power/l sub omega. (Sims-ISWS)
W80-03957

A RAINFALL-RUNOFF ANALYSIS OF THE GEOMORPHOLOGIC IUH,
Universidad Simon Bolivar, Caracas (Venezuela).
J. B. Valdes, Y. Fiallo, and I. Rodriguez-Iturbe.
Water Resources Research, Vol 15, No 6, p 1421-1434, December 1979. 20 Fig, 1 Tab, 8 Ref.

Descriptors: *Watersheds(Basins), *Geomorphology, *Rainfall, *Runoff, *Model studies, *Puerto Rico, Mathematical models, Rainfall-runoff relationships, Hydrologic properties, Streamflow, Hydrographs, Unit hydrographs, Synthetic hydrology, On-site investigations, Hydrology, *Venezuela, Hydrologic response, Geomorphologic structure.

The instantaneous unit hydrograph (IUH) derived from the geomorphologic characteristics of a basin and a timing component, the velocity of the discharge, was presented by Rodriguez-Iturbe and Valdes. To analyze this geomorphologic IUH in real world basins, a study was carried out on several basins in Venezuela and Puerto Rico. The geomorphologic IUH for each basin was compared with the IUH's derived from the discharge hydrograph produced by a physically based rainfall-runoff model of the same basins. The effects that the nonlinearities of the rainfall-runoff model have on the derivation of the IUH were analyzed, and further, controlled experiments were carried out in which the IUH was derived under constant velocity conditions. The geomorphologic IUH's and the ones obtained in the experiments were remarkably similar in all the basins analyzed. (Sims-ISWS)
W80-03958

EFFECT OF PERIODIC PARAMETERS ON THE AUTOCORRELATION STRUCTURE OF HYDROLOGIC SERIES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
For primary bibliographic entry see Field 2E.
W80-04039

THE WORTH OF HYDROLOGIC DATA,
Dames and Moore, Washington, DC.
For primary bibliographic entry see Field 7A.
W80-04043

THE WORTH OF HYDROLOGIC DATA FOR NONOPTIMAL DECISION MAKING,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6B.
W80-04044

KRIGING IN THE DESIGN OF STREAMFLOW SAMPLING NETWORKS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
For primary bibliographic entry see Field 7A.
W80-04047

TERMINATION OF HYDROLOGIC DATA COLLECTION (A CASE STUDY),
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 6B.
W80-04049

SIMULATED CHANGES IN GROUND-WATER LEVELS AND STREAMFLOW RESULTING FROM FUTURE DEVELOPMENT (1970 TO 2020) IN THE PLATTE RIVER BASIN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-04096

2B. Precipitation

RAINFALL MEASUREMENTS BY WEATHER RADAR: APPLICATIONS TO HYDROLOGY,
Research Council of Alberta, Edmonton. Atmospheric Science Div.
For primary bibliographic entry see Field 7B.
W80-03929

A STOCHASTIC DESCRIPTION OF WET AND DRY SPELLS IN TERMS OF AN EFFECTIVE NUMBER OF DAYS,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 6A.
W80-03938

CONSIDERATIONS FOR THE DESIGN OF A HYDROLOGIC DATA NETWORK USING MULTIVARIATE SENSORS,
National Weather Service, Fort Worth, TX. Southern Region.
For primary bibliographic entry see Field 7A.
W80-03941

DENSE NETWORKS TO MEASURE CONVECTIVE RAINFALL IN THE SOUTHWESTERN UNITED STATES,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 7A.
W80-03943

MEASUREMENTS OF RAINFALL INTENSITY, INSTRUMENTATION AND DATA PROCESSING,
Forsvarets Forskningsanstalt FOA, Stockholm (Sweden).
S. Wickerts, and S. Granath.
FOA rapport C 30157-E2, E1, January 1979. 31 p, 27 Fig, 2 Ref.

Descriptors: *Climatic data, *Rainfall intensity, *Instrumentation, *Data storage and retrieval, Precipitation(Atmospheric), Measurement, Data processing, Rain gages, On-site tests, Data transmission, Automation, Sampling, Foreign research, Statistical methods, Calibrations, On-site data collections, Precipitation gages, *Sweden.

At the National Defense Research Institute (FOA), a system for measuring the rainfall intensity was developed. The measurements with the complete system started in June 1977, and the continued measurements are planned to go on at least until 1980. In this paper the equipment, including the data-collecting system, was described in the first part. The second part of the paper dealt with the data handling from recording over corrections and checks via multiplication with the calibration factors to a data base containing rainfall rate (mm/H) minutes by minutes during occasions with rain from all the 24 rain gages used in the test area. Also described was some of the statistical treatment done on the data from the above-mentioned data base. (Humphreys-ISWS)
W80-04028

NETWORK DESIGN USING OPTIMAL ESTIMATION PROCEDURES,

Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 7A.
W80-04045

A CASE STUDY OF RATIONALIZATION OF A RAIN GAGE NETWORK IN SOUTHWEST ENGLAND,
Institute of Hydrology, Wallingford (England).
P. E. O'Connell, R. J. Gurney, D. A. Jones, J. B. Miller, and C. A. Nicholass.
Water Resources Research, Vol 15, No 6, p 1813-1822, December 1979. 5 Fig, 6 Tab, 3 Ref.

Descriptors: *Precipitation(Atmospheric), *Rain gages, *Networks, Gages, Optimization, Areal, Estimating, Rainfall, Spatial distribution, *Rain gage networks, *Case study, *England, *Southwest England, Rationalization, Wessex Water Authority, Optimal estimation, Point rainfall, Areal rainfall, Interpolation.

Redesign of the Wessex Water Authority daily and monthly rain gage networks in southwest England was proposed, based on optimal estimation procedures. Accuracy requirements for point and areal rainfall estimates were assessed from a survey of the use of data from the existing network. Root mean square errors of interpolation were calculated for the existing networks of 333 daily gages and 379 monthly gages using estimates of the spatial autocorrelation of daily and monthly rainfall. Maps of the interpolation accuracy were drawn and compared with the accuracy required by users. The accuracies of areal estimates in certain areas were also assessed. Three network configurations were designed of 75, 220, and 297 daily gages. The 220-gage network was found to provide satisfactory accuracies for most users and was adopted for implementation. (Roberts-ISWS)
W80-04046

USE OF PRINCIPAL COMPONENT ANALYSIS TO IDENTIFY HOMOGENEOUS PRECIPITATION STATIONS FOR OPTIMAL INTERPOLATION,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
For primary bibliographic entry see Field 7A.
W80-04048

2C. Snow, Ice, and Frost

CHELATION OF DIVALENT METAL IONS BY BROWN ALGAL POLYPHENOLS,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
M. A. Ragan, O. Smidsrod, and B. Larsen.
Marine Chemistry, Vol 7, p 265-271, 1979. 1 Fig, 1 Tab, 28 Ref.

Descriptors: *Phaeophyta, *Biochemistry, *Chelation, *Metals, *Marine algae, *Polyphloroglucinols, Chemical reactions, Chemical properties, Phenols, Chemical analysis, Organic compounds, Manganese, Strontium, Magnesium, Calcium, Cadmium, Cobalt, Zinc, Nickel, Lead, Copper, Beryllium.

High-molecular-weight, nondialyzable polyphloroglucinols from the marine brown algae Ascophyllum nodosum and Fucus vesiculosus (Phaeophyceae, Fucales) chelate the divalent metal ions $Sr2(+)$, $Mg2(+)$, $Ca2(+)$, $Be2(+)$, $Mn2(+)$, $Cd2(+)$, $Co2(+)$, $Zn2(+)$, $Ni2(+)$, $Pb2(+)$ and $Cu2(+)$ in weakly acidic aqueous solution. Values of the relative selectivity coefficients k have been calculated relative to $Mn2(+)$; the ionotropic series with the algal polyphenols are similar to those with catechol and pyrogallol. These studies may serve as a guide for the examination of metal chelation by brown algal polyphenols both in situ and after exudation into seawater. (Deal-EIS)
W80-03987

2D. Evaporation and Transpiration

AN ENERGY BUDGET ANALYSIS OF WATER USE BY SALTCEDAR,
Arizona Univ., Tucson. School of Renewable Natural Resources.
L. W. Gay, and L. J. Fritschen.
Water Resources Research, Vol 15, No 6, p 1589-1592, December 1979. 2 Fig, 3 Tab, 6 Ref. OWRT C-6030(No 5235)(6).

Descriptors: *Water utilization, *Tamarisk, *Energy budget, *New Mexico, Evapotranspiration, Phreatophytes, On-site investigations, Arid lands, Energy transfer, Analytical techniques, Analysis, On-site tests, Lysimeters, Latent heat.

Bowen ratio estimates of evapotranspiration (ET) over a stand of saltcedar (Tamarix chinensis) on the Rio Grande floodplain in central New Mexico provide (1) estimates of water use by saltcedar during hot, dry weather, (2) comparisons of ET measured at two different locations within the same stand, and (3) comparison of ET over natural stands with results obtained from four constant-level lysimeters. The mean ET for 5 consecutive days (June 14-18, 1977) was 8.2 mm/d by the Bowen ratio and 7.9 mm/d by the lysimeters. Vegetation on the lysimeters and at the Bowen ratio sites differed in density and vigor in a manner consistent with the evapotranspiration measurements. Given these differences, the agreement between methods was judged excellent. The agreement also substantiates the usefulness of the mobile, although more tedious, energy budget method for estimating evapotranspiration from riparian sites in arid zones. (Humphreys-ISWS)
W80-04020

URBAN LAWN EVAPOTRANSPIRATION--MEASUREMENT AND PREDICTION,
Pool (Charles) and Associates, Inc., Ketchikan, AK.
P. O'Neill, L. Pochop, and J. Borrelli.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 5, p 1050-1053, September-October 1979. 3 Fig, 3 Tab, 9 Ref. OWRT B-035-WYO(7), 14-34-0001-7201.

Descriptors: *Evapotranspiration, *Lawns, *Wyoming, Water rights, Lysimeters, Water users, Grasses, Evaporation, Consumptive use, *Urban lawn evapotranspiration, *Blaney-Criddle formula, Lawn grasses, Residential lawns, Lawn water requirements, Potential evapotranspiration, Lysimeter measurements.

A calibration of the Blaney-Criddle formula based on measurements of evapotranspiration rates directly from urban lawns was presented. Potential evapotranspiration rates were measured in Laramie and Wheatland, Wyoming, during the summers of 1976 and 1977. Measurements were taken using small weighable lysimeters located in lawns surrounding single family residences. The calibrated equations for the Criddle and others and the Soil Conservation Service methods provided improved estimates of evapotranspiration rates suitable for most engineering uses. The test locations represented a wide range of climatic conditions which allowed the calibrated equation to be used for bluegrass at other locations in the western United States. (Roberts-ISWS)
W80-04021

COMPREHENSIVE MONITORING OF METEOROLOGY, HYDRAULICS, AND THERMAL REGIME OF THE SAN DIEGO AQUEDUCT, CALIFORNIA,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson, and A. M. Sturrock, Jr.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00. Geological Survey Professional Paper 1137, 1979. 29 p, 31 Fig, 6 Tab, 5 Ref.

Descriptors: *Energy budget, *Hydrologic cycle, *Aqueducts, *California, *Evaporation, Canals, Data collections, Methodology, Water temperature, Meteorological data, Wind velocity, Solar radiation, Vapor pressure, Flow rates, Evaluation, Forecasting, *San Diego aqueduct(Calif), Concrete-lined canal, Atmospheric radiation, Hydraulic variables.

Water temperature, as well as meteorologic and hydraulic variables which influence the energy budget of the San Diego Aqueduct in southern California, were continuously monitored for a 1-year period beginning July 24, 1973. Incoming solar and atmospheric radiation, windspeed and direction, water temperature, and wet- and dry-bulb air temperatures were recorded at 10-minute intervals at each end of the 26-kilometer concrete-lined canal, while flow-rates and stages were determined at hourly intervals for five locations. Although only daily averaged values are presented in this report, all information necessary for the use and interpretation of these data are presented. Windspeeds were minimum during the early morning hours and maximum during the late afternoon; however, they were variable spatially. On the other hand, incoming radiation and absolute vapor pressure varied little from point to point. (Kosco-USGS)
W80-04100

THERMAL MODELING OF FLOW IN THE SAN DIEGO AQUEDUCT, CALIFORNIA, AND ITS RELATION TO EVAPORATION,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.75. Geological Survey Professional Paper 1122, 1980. 24 p, 21 Fig, 5 Tab, 21 Ref.

Descriptors: *Heat budget, *Model studies, *Canals, *Evaporation, *California, Energy budget, Aqueducts, Heat transfer, Hydrologic cycle, Computer models, Methodology, Data collections, Mass transfer, Water temperature, Air-water interface, Evaluation, Wind velocity, Meteorological data, Solar radiation, Vapor pressure, Flow rates, Monitoring, *San Diego Aqueduct, Concrete-lined canal, Atmospheric radiation, Hydraulic variables.

The thermal balance of the 26-kilometer long concrete-lined San Diego Aqueduct, a canal in southern California, was studied to determine the coefficients in a Dalton type evaporation formula. Meteorologic and hydraulic variables, as well as water temperature, were monitored continuously for a 1-year period. A thermal model was calibrated by use of data obtained during a 28-day period to determine the coefficients which best described the thermal balance of the canal. The coefficients applicable to the San Diego Aqueduct are similar to those commonly obtained from lake evaporation studies except that a greater evaporation at low windspeeds is indicated. The model was verified by use of data obtained during 113 days which did not include the calibration data. These data verified that the derived wind function realistically represents the canal evaporation. An annual evaporation of 2.08 meters was computed which is about 91 percent of the amount of water evaporated annually from nearby class A evaporation pans. (Kosco-USGS)
W80-04102

CONSUMPTIVE USE AND YIELDS OF CROPS IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
T. W. Sammis, E. G. Hanson, C. E. Barnes, H. D. Fuehring, and E. J. Gregory.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160732, Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University Report No 115, December 1979, 108 p, 21 Fig, 13 Tab, 21 Ref, 4 Append. OWRT B-054-NMEX(2), 14-34-0001-6100.

Descriptors: *Consumptive use, *Evapotranspiration, *Crop production, *Soil-water-plant relationships, *New Mexico, Measurement, Lysimeters, Evaporation pans, Irrigation, Alfalfa, Barley, Corn, Cotton, Rye, Grain sorghum, Bluegrass, Sudangrass, Crop production function, *Blaney Criddle equation.

Alfalfa, barley, bluegrass, corn, cotton, rye, grain sorghum, and sudangrass were grown at selected locations throughout the state of New Mexico. Lysimeters were installed in the center of the fields, and yields, monthly and yearly evapotranspiration rates, were measured in 1976 and 1977. In 1978, a sprinkler-line source was used to irrigate alfalfa and cotton in field plots for the measurement of yields and evapotranspiration. These data and data from other irrigation projects were used to derive crop-production functions for alfalfa, corn, cotton, and grain sorghum. Potential evapotranspiration (PET) was determined at each study area using the methods of Penman, Jensen-Haise, Van Bavel, Priestly-Taylor, net radiation, modified pan, and pan evaporation. These data were combined with the evapotranspiration measured in lysimeters to determine a monthly and yearly crop coefficient by each method used to compute PET. Measured seasonal evapotranspiration values are compared to those computed by these techniques. (Herman-NMex)
W80-04107

2E. Streamflow and Runoff

PERSISTENCE MODELING FOR THE POTOMAC AND ADJACENT RIVERS,
Washington Technical Inst., DC. Water Resources Research Center.
G. K. Young, and R. U. Jettmar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158280, Price codes: A03 in paper copy, A01 in microfiche. Report No 12, September 1977. 26 p, 7 Fig, 17 Ref. OWRT-B-008-DC(1).

Descriptors: *Mathematical models, *Persistence, *Flow characteristics, Low-flow frequency, Flow rates, Flow duration, Droughts, Low flow, Hydrologic budget, Water shortage, Monte Carlo method, Probability, Statistical models, Least squares method, Critical flow.

Case studies of three rivers are used to analyze a persistence modeling strategy for the generation of synthetic stream flows for drought assessment probabilities and confidence levels. The predominantly unregulated river sites used in the study are the Patuxent River near Unity, Maryland, the Potomac River at Point of Rocks, Maryland, and the Rappahannock River near Fredericksburg, Virginia. In an effort to improve the use of Monte Carlo models to produce drought characteristics from synthetic data, the strategy employed for the study uses least squares to fit theoretic autocorrelation functions to empiric functions. The model is designed to aid in critical period analysis in the designing of reservoirs to meet water requirements by solving the major problem of previous models, having an historic critical period or drought of greater severity than can be captured by the model. A key assumption of the modeling method used is that normalized monthly data are stationary. Flow analysis is discussed and illustrated with a chart. Two types of drought phenomena can be defined from the critical period analysis of historic streamflow, (1) short term drought (extreme low flow for six to eight months), and (2) long term drought (lower than historic yearly average flow for three to five years). Graphs of critical flows are given for the three cases studied. Results show that the least squares method produces lower errors, that all methods produce errors of about 10% or less for critical periods of over three years, and for short droughts all methods produced errors of over 10%. (Seigler-IPA)
W80-03916

STORM TRAVEL DISTANCE CALCULATIONS FOR TOTAL PHOSPHORUS AND SUSPENDED MATERIALS IN RIVERS,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W80-03930

DEVELOPMENT OF HYDROMETRIC NETWORKS IN BRITISH COLUMBIA,
Water Survey of Canada, Vancouver (British Columbia).
For primary bibliographic entry see Field 7A.
W80-03944

STABILIZED SAND SURFACES FOR OVERLAND FLOW STUDIES,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
T. H. Podmore, and J. R. Burney.
Water Resources Research, Vol 15, No 6, p 1647-1648, December 1979. 10 Ref.

Descriptors: *Surfaces, *Hydraulic models, *Overland flow, *Surface sealing, Coatings, Roughness(Hydraulic), Sands, Methodology, Plastics, Polymers, Stabilized sand surfaces.

A method was developed to produce stable durable sand surfaces for use in overland flow studies. Hydraulic and physical characteristics of the surfaces produced could be quantified repetitively without deterioration. Due to the inability to reject undesirable bed forms using Portland cement, polyester resins used for laminating fiberglass were tested. Both clear laminating and casting resins in solution with styrene monomer were used on test samples and on full size beds. The surfaces formed had a variety of channel forms and the appearance of natural wet sand. No deterioration was found following repeated hydraulic testing and measurement of physical surface characteristics. In addition, the beds were solid enough to walk on with some care and provided access to all points. Total time for formation of a surface was approximately 10 days including drying time. (Humphreys-ISWS)
W80-03945

IMPACT OF ROAD NETWORKS ON SOUTHEASTERN MICHIGAN LAKESHORE DRAINAGE,
Michigan Univ., Ann Arbor. Dept. of Geography.
E. N. Bannister.
Water Resources Research, Vol 15, No 6, p 1515-1520, December 1979. 5 Fig, 14 Ref.

Descriptors: *Streams, *Drainage, *Michigan, *Lake Michigan, Drainage density, Geomorphology, Lake shores, Sediment transport, Channels, Runoff, Drainage patterns(Geologic), Roads, *Road networks, Upland drainage.

The postglacial drainage of till plains and lake beds by perennial and intermittent streams in southeastern Michigan reveals local adjustments caused by human activity. The present drainage pattern reflects the construction and subsequent maintenance of the local road network. The impact of the road grid on the linear coastal drainage off the Port Huron Moraine's eastern flank was studied from Lexington Heights to Forester, Michigan. Borrow pits supplied the aggregate used to construct bridges and culverts. These facilities restrict flow and reduce transportation of sediment-laden runoff. This results in increased but localized sedimentation. The extension, maintenance, and use of road networks has artificially increased the drainage density of the region by creating additional avenues for surface flow. Road networks also truncate natural drainage channels, forcing the coalescence of the smaller order basins, thereby increasing downcutting and runoff in channels whose natural erosional development would have been much less. Channel reaches whose upland drainage has been pirated experience decreased runoff and exhibit less erosion. Such modern changes in drainage topology pose problems to the reconstruction of historical postglacial drainage patterns, since they result in greater stream drainage density. (Lee-ISWS)
W80-03951

DISCHARGE RESPONSE ANALYSIS AND HYDROLOGIC SIMILARITY: THE INTERRELATION BETWEEN THE GEOMORPHOLOGIC IUH AND THE STORM CHARACTERISTICS,
Universidad Simon Bolivar, Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-03957

A RAINFALL-RUNOFF ANALYSIS OF THE GEOMORPHOLOGIC IUH,
Universidad Simon Bolivar, Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-03958

CHELATION OF DIVALENT METAL IONS BY BROWN ALGAL POLYPHENOLS,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
For primary bibliographic entry see Field 2C.
W80-03987

USE OF EXTREME VALUE THEORY IN ESTIMATING FLOOD PEAKS FROM MIXED POPULATIONS,
Utah Water Research Lab., Logan.
R. V. Canfield, D. R. Olsen, R. H. Hawkins, and T. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-161052, Price codes: A03 in paper copy, A01 in microfiche. Hydraulics and Hydrology Series UWRL/H-80/01, February 1980. 42 p, 29 Fig, 12 Tab, 8 Append. OWRT-B-173-UTAH(1), 14-34-0001-9100.

Descriptors: *Flood peaks, Flood frequency, Runoff, *Flood forecasting, *Peak discharge, Streamflow, Flood flow, Planning, flood control, Flood plain management, Extreme value theory, Mixed populations, Empirical goodness-of-fit, Fisher-Tippett function, Gumbel distribution, Log-Pearson type III distribution.

A number of extreme-value distributions are examined, and plotting tests are provided for selecting one particularly applicable to flow series composed of the largest flow from each year of record. The generally most appropriate was found to be not the Gumbel distribution, which assumes neither an upper nor a lower bound to the possible flood flows, but rather a form adding a third parameter as an upper bound to the flood flow. The existence of such an upper bound seems reasonable hydrologically, and a maximum likelihood fit of this distribution to 14 stations around the world with over 50 years of record compares favorably with that of the log-Pearson type III distribution. More efficient parameter estimating techniques are, however, needed. The plotting tests for many series were found to exhibit a break between two linear portions suggesting that the recorded flows may in fact be drawn from two or more populations. The form of a distribution of a series drawn as a mixture from two populations is shown theoretically to be multiplicative with respect to the two functions (rather than having the more commonly used additive form). A five parameter distribution was applied to 11 long-term sequences shown by the plotting test to originate from nonhomogeneous sources. The fit was generally excellent.
W80-04015

THE WORTH OF STREAMFLOW DATA IN WATER RESOURCES PLANNING: COMPUTATIONAL RESULTS,
Case Western Reserve Univ., Cleveland, OH.
Y. Y. Haimes, J. A. Craig, and J. Subrahmanian.
Water Resources Research, Vol 15, No 6, p 1335-1342, December 1979. 9 Fig, 11 Tab, 18 Ref, 1 Append. OWRT C-6027(No 5202)(2), 14-31-0001-5202.

Descriptors: *Streamflow, *Water resources, *Data collections, *Model studies, Mathematical models, Data processing, Costs, Planning, Water yield, Rivers, Hydrology, Synthetic hydrology, Methodology, Analytical techniques.

This paper presented computational results for evaluating the worth of streamflow data in water resources planning. Synthetic streamflow was generated with a synthetic streamflow generator, HEC-4 simulation model, where the optimal scheduling and capacity expansion of water supply projects were determined with a dynamic programing model. Penalty matrices associated with high- and low-yield estimates were then developed, using the results from the HEC-4 and the dynamic programing models. A multiobjective op-

timization problem was then formulated, minimizing the expected monetary penalty (in dollars) and the expected water shortage penalty (in million gallons). The solution of the multiobjective optimization problem (by using the surrogate worth trade-off (SWT) method) yielded a Pareto optimal and preferred data collection policy. (Sims-ISWS)
W80-04019

APPLICATION AND ANALYSIS OF A COUPLED SURFACE AND GROUNDWATER MODEL,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
A. B. Cunningham, and P. J. Sinclair.
Journal of Hydrology, Vol 43, No 1/4, p 129-148, October 1979. 4 Fig, 4 Tab, 19 Ref. OWRT B-078-NEV(2).

Descriptors: *Streamflow, *Groundwater, *Nevada, *Model studies, Mathematical models, Equations, Channel flow, Streams, Rivers, Open channel flow, Water levels, Groundwater movement, Finite element analysis, Mathematics, Analytical techniques, Hydrology, *Truckee River(NV).

A model which couples two-dimensional, transient, saturated subsurface flow (Boussinesq equation) and one-dimensional, gradually-varied, unsteady, open-channel flow (Saint-Venant equations) was developed and applied to the Truckee River system in norhtern Nevada. The coupled model involved simultaneous numerical solution of the surface and subsurface flow equations using the Galerkin finite-element method. This paper attempted to address questions regarding the application of such a model to both real and hypothetical hydrologic systems in terms of analysis of parameter sensitivity, predictive uncertainty, and uniqueness of model solution. Investigation of parameter sensitivity provides information regarding the relative accuracy with which individual system parameters should be measured in order to insure successful model operation. Model predictive uncertainty was evaluated based on comparison of model output and field observations obtained over a two-year period from the Truckee River study area in northern Nevada. Results indicated fair to good prediction of both high and low river stage and groundwater table elevations with predictive accuracy decreasing with distance away from river channel. A procedure for quantifying uniqueness of model solution was developed to provide insight into the reliability associated with extrapolation of model output beyond the limits of observed field measurements. Based on results for the Truckee River system, such extrapolation appears to be justified. (Sims-ISWS)
W80-04024

EFFECT OF PERIODIC PARAMETERS ON THE AUTOCORRELATION STRUCTURE OF HYDROLOGIC SERIES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Water Resources Research, Vol 15, No 6, p 1639-1642, December 1979. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Correlation analysis, *Model studies, *Hydrology, Mathematical models, Time series analysis, Stochastic processes, Rainfall, Runoff, Flow, Streamflow, Evaporation, Analytical techniques, Autocorrelation, Periodic parameters.

The autocorrelation structure of a seasonal hydrologic series was analytically investigated, given a set of periodic parameters such as the means, standard deviations, and seasonal serial correlations between any two seasons. It was observed that periodic means have the most important effect on the correlogram of the seasonal data, whereas the periodicities in the standard deviations and seasonal serial correlations have minor effects which might easily be neglected in the practical hydrological studies of any water resources system design. (Sims-ISWS)
W80-04039

A STATISTICAL APPROACH TO STATION DISCONTINUANCE,
Princeton Univ., NJ. Dept. of Civil Engineering.
E. F. Wood.
Water Resources Research, Vol 15, No 6, p 1859-1866, December 1979. 9 Fig, 1 Tab, 9 Ref.

Descriptors: *Hydrologic data, *Sampling, *Value, *Decision making, Stations, Statistical methods, Hydrologic aspects, Network design, Probability, Analytical techniques, Floods, Data collections, Statistics, Streamflow, Costs, Variability, Discharge(Water), *Susquehanna River(PA), *Harrisburg(PA), Station discontinuance.

The sequential probability ratio test (SPRT) was developed and applied to the station discontinuance problem. The decision whether to discontinue a station is dependent upon statistical considerations that include the error probabilities of accepting a model when it is incorrect as well as rejecting it when it is correct. Both error probabilities can be explicitly set by using the SPRT approach so that the decision rules are: accept model 1, accept model 2, continue to sample (cannot accept either). The error probability levels are a decision variable that depends upon the use of the data and the cost of collection. Procedures were developed for determining the expected benefits from sampling one additional time within the SPRT framework. The SPRT approach was applied to the Susquehanna River at Harrisburg, Pennsylvania. The results of the analysis show that the Log-Pearson III distribution is statistically superior to three other competing models and that data collection could be ceased after 76 years. The analysis used a probability of error of 0.05. The paper also showed how the cost of sampling can be used in conjunction with SPRT to analyze station discontinuance. (Humphreys-ISWS)
W80-04050

ESTIMATION OF FLOODS OF VARIOUS FREQUENCIES FOR THE SMALL EPHEMERAL STREAMS IN EASTERN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. L. Haushild.
Geological Survey Water-Resources Investigations 79-81 (open-file report), 1979. 22 p, 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Estimating, *Floods, *Frequency analysis, *Ephemeral streams, *Regional analysis, Analytical techniques, Data collections, Sites, Watersheds(Basins), Equations, Regression analysis, Estimating equations, Streamflow, Drainage area, Peak discharge, Flood forecasting, Flood recurrence interval, Precipitation(Atmospheric), *Eastern Washington.

Equations were developed to estimate the magnitude of floods for various occurrence frequencies at ungaged sites on ephemeral streams that drain small, relatively undeveloped basins in the semiarid part of eastern Washington. The equations were developed from regression analyses that used the logarithms of the longitude indexes of gaged sites, forest cover, and drainage areas of the upstream basins as independent variables and the logarithms of the discharges for selected exceedance-probabilities at the gaged sites were used as dependent variables. These equations may be used to estimate floodflows with probabilities of being exceeded in any year of 50, 20, 10, 4, 2, and 1 percent in natural-flow ephemeral streams that drain relatively undeveloped basins with areas and forest covers less than about 40 square miles and 30 percent, respectively. The standard errors of estimate for the equations range from 57 to 100 percent. Equations that use longitude index as a surrogate for a precipitation index more accurately estimate floods than do equations that use mean annual precipitation, which, in turn, are better than the equations that use the 24-hour precipitation with an exceedance probability of 50 percent. (Kosco-USGS)
W80-04093

STATISTICAL ANALYSIS OF NITRATE CONCENTRATIONS FROM THE RIVER FROME (DORSET) FOR THE PERIOD 1965-76,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 5B.
W80-04101

FLOOD HAZARD STUDY -- BERKLEY CREEK AND TRIBUTARIES, HALL COUNTY, TEXAS.
Soil Conservation Service, Temple, TX.
Prepared in cooperation with the Hall-Childress Soil and Water Conservation District Hall County Commissioners Court, City of Memphis and the Texas Department of Water Resources, October 1979. 103 p, 43 Fig, 4 Tab, 12 Ref, 1 Append.

Descriptors: *Flood forecasting, *Texas, *Land use, *Flood data, Flood profiles, Flood peak, Flood frequency, Flood plain zoning, Flood protection, Mapping, Streamflow, Urbanization, Flood recurrence interval, Watersheds(Basins), Ranges.

Areas subject to flooding by Berkley Creek and its major tributaries were identified as a guide to aid in decisions concerning land use and future development in the Memphis, Texas, area. Berkley Creek, located in the northeast part of Hall County, has a total drainage area of 22.5 square miles or 14,400 acres at its confluence with Parker Creek. Average rainfall for the area is about 20.53 inches. Of the land in the watershed 7,214 acres are native rangeland, 5,765 acres are cropland, and 1.421 acres are urban. Involved in the hazard study are 5.5 miles of Berkley Creek, 4.5 miles of Parker Creek, and parts of four tributaries. Approximately 40% of the flood plain is used for agriculture with cotton being the major crop. Approximately 50% of the flood plain is rangeland mostly covered by short and mid grasses. There is some minor flooding every year with serious damage occurring about once every three to five years such as in 1950, 1954, 1955, 1956, 1960, 1973, 1975, 1978, and 1979. A flood in excess of a 500-year event occurred June 2, 1973. Aerial photographs are used to illustrate the limits of 100-year and 500-year frequency floods for the areas studied. Water surface profiles are used to show 10-year, 50-year, 100-year, and 500-year floods for the streams including stream elevation, channel bottom, and bridge and roadway data. Local recommendations and various flood plain management measures are discussed. (Seigler-IPA)
W80-04103

A QUANTITATIVE ANALYSIS OF STREAMFLOW: THE IMPORTANCE OF PRECIPITATION AND GEOMORPHIC FACTORS IN DETERMINING YIELDS FROM SMALL WATERSHEDS,
Idaho Univ., Moscow. Coll. of Letters and Science.
For primary bibliographic entry see Field 6A.
W80-04106

NUMERICAL ABUNDANCE AND BIOMASS OF BACTERIA, ALGAE AND MACROBENTHOS OF A LARGE NORTHERN RIVER, THE ATHABASCA,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-04127

THE 1976-1977 CALIFORNIA DROUGHT--A REVIEW,
California State Dept. of Water Resources, Sacramento.
May 1978. 228 p, 39 Fig, 11 Tab, 58 Illus, 83 Ref, 8 Append.

Descriptors: *Water resources, *Droughts, *Water shortage, *Water storage, *California, *Water supply, Water management(Administrative), Water demand, Hydrologic budget, Rationing(Water), Social aspects, Average runoff, Reservoir storage, Irrigation, Water utilization, Agriculture, Groundwater utilization, Legislation, Water conservation.

This report outlines the serious 1976-1977 drought in California, and includes a description of state and other program responses to the emergency. In

the 1976 water year annual precipitation was only 65% of average. In the 1977 water year, precipitation was even less--45% of average. Runoff to major streams and rivers was reduced to 47% and 22% for 1976 and 1977, respectively. Water storage in major reservoirs dropped during 1976 and 1977, with water storage in 143 major reservoirs dropping to 37% of the average for October 1, 1977, with some reservoirs dropping to as low as 5% of the 10-year average. All 13 state hydrologic regions were affected. Ground water use increased greatly during the period. The responses to the drought included emergency U.S. Department of Interior aid in order to augment community water supplies, to assist in water purchase and transport, and to promote conservation. Further aid came from U.S. Economic Development Administration and the Small Business Administration to aid especially water-dependent small businesses. The California Department of Water Resources established a drought information center, pilot conservation program, emergency loans, and special technical assistance to local governments. During 1978, most reservoirs recovered to normal or near normal stages. Urban area conservation programs are now in effect and are expected to meet future drought emergencies more effectively than did past programs. (Arnold-NC)
W80-04189

2F. Groundwater

GROUNDWATER BASIN MODELING USING THE FINITE ELEMENT METHOD - YOLO COUNTY CASE STUDY,
California Univ., Davis, Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6A.
W80-03904

MATHEMATICAL MODELLING OF GROUND-WATER FLOW,
G. Kovacs.
Vituki, 1978. 92 p, 31 Fig, 2 Tab, 44 Ref. Published by the Research Centre for Water Resources Development, Budapest (Hungary). Haszpra, O., editor.

Descriptors: *Mathematical models, *Groundwater movement, *Flow, *Porous media, *Hydraulic structures, Analytical techniques, Earth dams, Seepage, Flow characteristics, Model studies, Equations, Mathematics, Potential flow, Flow nets, Finite element analysis, Numerical analysis, Saturated flow, Unsaturated flow, Drawdown, Water table, Aquifers, Piezometry.

The practical problems of seepage to be solved in connection with the design and operation of hydraulic structures (dams, canals, wells, etc.) require the knowledge of the main hydraulic parameters of the water movement developing through the porous medium as a result of pressure difference prevailing between two points or section of the latter. The broad subject areas presented included: (1) general principles concerning the application of mathematical models and numerical methods to kinematic relationships characterizing seepage, and geometrical and kinematic classification of seepage; (2) solution of movement equations with numerical methods for boundary and initial conditions through porous media; (3) practical application of numerical methods for determination of flow nets in the cases of two-dimensional seepage, estimation of the influence of exploitation on groundwater regime, and investigation of multilayered aquifer systems. (Humphreys-ISWS)
W80-03927

STOCHASTIC ANALYSIS OF MACRODISPERSION IN A STRATIFIED AQUIFER,
New Mexico Inst. of Mining and Technology, Socorro.
L. W. Gelhar, A. L. Gutjahr, and R. L. Naff.
Water Resources Research, Vol 15, No 6, p 1387-1397, December 1979. 9 Fig, 38 Ref, 4 Append.

Descriptors: *Aquifers, *Groundwater, *Dispersion, *Model studies, Mathematical models, Stochastic processes, Hydraulic conductivity, Stratification, Groundwater movement, Statistics, Statistical models, Mass transfer, Flow, Hydrology, Macrodispersion, Stratified aquifer.

The longitudinal dispersion produced as a result of vertical variations of hydraulic conductivity in a stratified aquifer was analyzed by treating the variability of conductivity and concentration as homogeneous stochastic processes. The mass transport process was described using a first-order approximation which is analogous to that of G.I. Taylor for flow in tubes. The resulting stochastic differential equation describing the concentration field was solved using spectral representations. The results of the analysis demonstrated that for large time the longitudinal dispersivity approaches a constant value which is dependent on statistical properties of the medium. The analysis also described the transient development of the dispersive process and some non-Fickian effects which occur early in the displacement process. (Sims-ISWS)
W80-03928

A PLANNING MODEL FOR THE MANAGEMENT OF GROUNDWATER QUALITY,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
R. Willis.
Water Resources Research, Vol 15, No 6, p 1305-1312, December 1979. 2 Fig, 7 Tab, 19 Ref.

Descriptors: *Groundwater, *Water quality, *Management, *Model studies, Mathematical models, Pumping, Injection, Injection wells, Waste disposal wells, Water wells, Hydraulic conductivity, Storage, Aquifers, Finite element analysis, Hydrology.

A dynamic planning model is presented for the optimal management of groundwater quality in regional aquifer systems. The groundwater system was conjunctively managed as a water supply resource and as a storage reservoir for wastewater residuals. The waste-waters were discharged to the groundwater basin through injection wells. Within the groundwater system, constituents were assumed to follow first-order chemical or biochemical reactions and linear equilibrium adsorption. The Galerkin finite element method was used to transform the flow and mass transport equations of the aquifer system into systems of ordinary differential equations which were imbedded as constraint equations in the planning model. The mathematical model, which was structured as a nonconvex programing problem, allows the planner or resource manager to determine (1) the optimal pumping and injection schedules (rates and locations) required to satisfy an exogenous water target and waste load demand and (2) the maximum injection concentrations that can be discharged to the basin without degrading the quality of the aquifer. Operational policies were developed for a 480-day operational cycle for a hypothetical groundwater basin, where it was assumed that groundwater extraction represents the principal resource of the aquifer system. Linear programing was used to identify the optimal planning policies. The important parameters affecting the optimal decisions were discussed. (Sims-ISWS)
W80-03932

DETERMINATION OF RECHARGE RATES USING TEMPERATURE-DEPTH PROFILES IN WELLS,
Environmental Protection Agency, Chicago, IL. Region V.
J. M. Boyle, and Z. A. Saleem.
Water Resources Research, Vol 15, No 6, p 1616-1622, December 1979. 7 Fig, 2 Tab, 38 Ref.

Descriptors: *Groundwater recharge, *Aquifers, *Illinois, *Hydrogeology, *Mathematical models, Recharge, Porous media, Dolomite, Analytical techniques, Analysis, On-site investigations, Water temperature, Heat transfer, Soil temperature, Groundwater movement, Profiles, Leakage, Infiltration, Natural recharge.

Recharge rates to the shallow dolomite aquifer in northeastern Illinois were determined using a theory which describes the simultaneous transfer of heat and fluid in a porous medium. Temperature-depth profiles in a nonpumping well are used to determine vertical groundwater velocities of the downward leakage of water recharging the aquifer which is overlain by semiconfining beds of clay-rich glacial drift. Calculated and observed depths of penetration (19 m) of the annual surface temperature wave, and demonstration of the thermal stability of the well, validate application of the theory, which uses a dimensionless parameter beta to relate curvature in temperature-depth profiles to the magnitude of vertical leakage. Generally, the magnitude of beta decreases as the depth interval L within the aquitard increases. The corresponding decrease in the vertical component of groundwater velocity accompanies a gradual coarsening with depth of the aquitard materials. Temperature differences over time at a given depth within a thermally stable well are found to be within the accuracy of the temperature measuring system. Analysis of variations in beta over time shows that the variability can be due to the limitations of the resolution (0.01C) of the temperature measuring system. Recharge rates determined by analysis of temperature-depth profiles range from 2.47 x 10 to the minus 9th power to 9.86 x 10 to the minus 9th power m/s and agree with estimates resulting from water-budget method. (Humphreys-ISWS)
W80-03946

SOIL SPATIAL VARIABILITY AND ITS CONSEQUENCES ON SIMULATED WATER BALANCE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2G.
W80-03947

STOCHASTIC ANALYSIS OF STEADY STATE GROUNDWATER FLOW IN A BOUNDED DOMAIN, 2. TWO-DIMENSIONAL SIMULATIONS,
Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
L. Smith, and R. A. Freeze.
Water Resources Research, Vol 15, No 6, p 1543-1559, December 1979. 14 Fig, 1 Tab, 23 Ref.

Descriptors: *Groundwater, *Groundwater movement, *Stochastic processes, *Model studies, Mathematical models, Hydraulic conductivity, Flow, Aquifers, Boundary processes, Pressure, Hydrology, Analytical techniques, Hydraulic head.

A stochastic analysis of two-dimensional steady state groundwater flow in a bounded domain was carried out by using Monte Carlo techniques. The flow domain was divided into a set of square blocks. A nearest-neighbor stochastic process model was used to generate a multilateral spatial dependence between hydraulic conductivity values in the block system. Both statistically isotropic and statistically anisotropic autocorrelation functions were considered. This model lead to a realistic representation of the spatial variations in hydraulic conductivity in a discrete block medium. Results of the simulations provided estimates of the output distributions in hydraulic head. The probability distribution for hydraulic head must be interpreted in terms of the spatial variation of the expected head gradients, the standard deviation in the hydraulic conductivity distribution, the ratio of the integral scales of the autocorrelation function for conductivity to the distance between boundaries on the flow domain, and the arrangement of statistically homogeneous units within the flow domain. The standard deviation in hydraulic head increases with an increase in either the standard deviation in hydraulic conductivity or the strength of the correlation between neighboring conductivity values. The standard deviations in hydraulic head are approximately halved when a uniform, bounded, two-dimensional flow field is reduced to one-dimensional form. The uncertainties in the predicted hydraulic head values are strongly influenced by the presence of a spatial trend in the mean hydraulic conductivity. In evaluating the concept of an effective conductivity for a heterogeneous medium, both the nature of the spatial heterogene-

ities in hydraulic conductivity and the flow system operating within the flow domain must be considered. (Sims-ISWS)
W80-03949

EFFECT OF INFILTRATION RATE ON BIOLOGICAL CLOGGING AND WATER QUALITY CHANGES DURING ARTIFICIAL RECHARGE,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W80-03950

THERMAL ENERGY STORAGE IN A CONFINED AQUIFER: EXPERIMENTAL RESULTS,
Auburn Univ., AL. Dept. of Civil Engineering.
F. J. Molz, A. D. Parr, P. F. Andersen, V. D. Lucido, and J. C. Warman.
Water Resources Research, Vol 15, No 6, p 1509-1514, December 1979. 12 Fig, 1 Tab, 17 Ref.

Descriptors: *Storage, *Thermal water, *Aquifers, *Groundwater, Hydraulic conductivity, Injection wells, Observation wells, Temperature, Water temperature, Energy, Pumping, Clogging, On-site investigations, Hydrology, Thermal energy storage.

To aid in testing the idea of storing thermal energy in aquifers, an experiment was performed by Auburn University in which 54,784 cu m of water were pumped from a shallow supply aquifer, heated to an average temperature of 55C, and injected into a deeper confined aquifer where the ambient temperature was 20C. After a storage period of 51 days, 55,345 cu m of water were produced from the confined aquifer. Throughout the experiment, which lasted approximately 6 months, groundwater temperatures were recorded at 6 depths in each of 10 observation wells, and hydraulic heads were recorded in 5 observation wells. In order to prevent errors due to thermal convection, most of the observation wells recording temperature had to be backfilled with sand. During the 41-day production period, the temperature of the produced water varied from 55 to 33C, and 65% of the injected thermal energy was recovered. At no time was an appreciable amount of free thermal convection observed in the storage formation. The dominant heat dissipation mechanisms appeared to be hydrodynamic thermal dispersion and possible mixing of cold and hot water induced by clogging and unclogging of the injection-production well. On the basis of laboratory and field studies, it was concluded that clogging of the injection well, which constituted the major technical problem during the experiment, was caused by the freshwater-sensitive nature of the storage aquifer. Due to the relatively low concentration of cations in the supply water, clay particles would swell disperse, and migrate until they became trapped in the relatively small pores connecting the larger pores. Surging the pump and back washing the injection well would dislodge the clogging particles and temporarily improve the storage formation permeability. (Sims-ISWS)
W80-03952

MODELING GROUNDWATER FLOW FIELDS CONTAINING POINT SINGULARITIES: STREAMLINES, TRAVEL TIMES, AND BREAKTHROUGH CURVES,
Stanford Univ., CA. Dept. of Civil Engineering.
R. J. Charbeneau, and R. L. Street.
Water Resources Research, Vol 15, No 6, p 1445-1450, December 1979. 5 Fig, 16 Ref. EPA-R-804431.

Descriptors: *Mathematical models, *Groundwater movement, *Travel time, Equations, Hydraulic properties, Wells, Velocity, Water pollution, Numerical analysis, Artificial recharge, Injection wells, *Streamlines, *Point singularities, *Breakthrough curves, *Transport models, Hydraulic head.

In the work of Charbeneau and Street (1979) a method was presented for modeling steady state groundwater flow fields containing injection and extraction wells. The Galerkin finite element method was used with greatly improved accuracy of the simulation near wells achieved by removing the singular behavior of the flow with an analytic solution for the near-well zone, solving the nonsingular problem, and combining the results. In this paper, methods for exploiting the improved hydraulic head solution were presented. Velocity fields are derived through differentiation of the head solution combined with smoothing and averaging. The velocity fields are used for generating systems of streamlines and determining times of travel to points of interest (including breakthrough curves for a nondispersive contaminant). The method was compared with analytical results for a single injection-extraction well pair. (See also W80-00609) (Visocky-ISWS)
W80-03956

REGIONAL IDENTIFICATION OF SALINE-SEEP RECHARGE AREAS, STILLWATER AND YELLOWSTONE COUNTIES, MONTANA,
Montana State Univ., Bozeman. Dept. of Earth Sciences.
S. G. Custer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159684, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University Publication No 102, November 1979, 58 p, 9 Fig, 5 Tab, 29 Ref. OWRT A-111-MONT(1), 14-34-0001-9028.

Descriptors: *Saline water, *Groundwater recharge, *Recharge ponds, Soil water movement, Seepage, Land management, Hydrology, Marsh plants, Forage grasses, Specific conductance. *Saline seep, *Recharge area, *Natural recharge, Northern Great Plains, Montana, Stillwater County(Mont), Recharge area identification, *Geologic mapping.

Saline seep causes lost grain production, impassable roads, flooded basements, and stock deaths throughout the Northern Great Plains. The problem can be reduced by flexible cropping in the groundwater recharge area. The recharge area for each saline seep can be identified most efficiently on a regional scale. Saline seep recharge areas were identified in a 600 sq. mi. area in Stillwater and Yellowstone counties, Montana. The area was examined for regional soil and geologic factors which might control the problem. The principal control is the presence of a large internally-drained basin. The surface-water drainage basin contributing to each saline seep coincides with the recharge area for that seep. This relationship exists because the groundwater flow system is shallow and controlled by local topography. Problem areas were clarified by visual observation of plant communities and surface salt; and study of the specific electrical conductance of the water and soil. Communication of the results to the farmers in the area is an important part of the problem solution. The farmers locate themselves using cultural features. The 1:24,000 orthopotograph map base shows the cultural features clearly. The final recharge-area-map overlay includes farmstead names so that the farmer can locate himself easily.
W80-03959

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ. Tucson. Dept. of Geosciences.
J. S. Summer, and F. J. Christie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159908, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona. Partial Project Completion Report, March 1980. 5 p. OWRT A-073-ARIZ(3), 14-34-0001-7005, 7006 and 8003.

Descriptors: *Land subsidence, *Fissures(Geologic), *Forecasting, Model studies, Geohydrologic units, Bedrock, Arizona, *Gravity exploration, Alluvial basins.

This research was directed toward the understanding of land subsidence, particularly as associated with the occurrence of earth fissures, as found in alluvial basins. The gravity exploration method was employed to survey the Picacho basin area in south-central Arizona where numerous fissures are located and where the land has subsided in excess of 12.5 feet (3.96 m) since 1952. A differential subsidence concept would predict that vertical offset fissures would most likely occur over basement irregularities. Therefore, the gravity data were interpreted in terms of the probable variation in thickness of alluvium overlying the more dense bedrock. Modeling of the bedrock surface under the basin area reveals a strong correlation between gravity gradients and earth fissures. Of earth fissures peripheral to the Picacho basin, 83 percent were correlated to lie with + or - 1/2 mile of a modeled bedrock surface irregularity. Thus it can be concluded that most vertical offset earth fissures are related to bedrock irregularities, and that the gravity method holds promise in predicting the probable occurrence of these features. (See also W79-02599)
W80-04013

CONSIDERATION OF TOTAL ENERGY LOSS IN THEORY OF FLOW TO WELLS,
Nevada Univ. System, Reno. Water Resources Center.
R. L. Cooley, and A. B. Cunningham.
Journal of Hydrology, Vol 43, No 1/4, p 161-184, October 1979. 7 Fig, 1 Tab, 18 Ref, 1 Append. OWRT A-061-NEV(2), 14-31-0001-5028.

Descriptors: *Groundwater, *Water wells, *Model studies, Mathematical models, Groundwater movement, Drawdown, Pumping, Porous media, Aquifers, Aquitards, Equations, Finite element analysis, Hydraulic conductivity, Hydrology.

A coupled numerical solution was developed for unsteady flow in single or multiple confined or semiconfined aquifers and in the well penetrating the system. Analysis of hypothetical problems indicated that, because of friction losses and nonuniform flow in the well bore, a significant region of nonradial flow in the aquifer(s) results whenever aquifer hydraulic conductivity is greater than about 0.015 m/min and pumping rate is greater than about 1.2 cu m/min. Because of this nonradial flow, use of standard aquifer testing equations can lead to significant errors in computed aquifer transmissivity whenever aquifer hydraulic conductivity is greater than about 0.03 m/min. Because of unsteady flow in the well bore, flow may be highly nonradial for the first few seconds of pumping irrespective of hydraulic conductivity or pumping rate. Percentage of open area in the screened or perforated section of well bore, Fanning friction factor, and contraction coefficients characterizing flow through the perforations or slots are parameters that could cause large head losses in the well in some cases. Expressions for parameters B and C in the total drawdown equation s sub w = BQ + CQ to the 2 power (where s sub w is drawdown in the well and Q is pumping rate) were developed dimensionally from expressions used in this study. The development shows that both B and C could theoretically be dependent on Q. (Sims-ISWS)
W80-04022

APPLICATION AND ANALYSIS OF A COUPLED SURFACE AND GROUNDWATER MODEL,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2E.
W80-04024

DUMANLI SPRING, TURKEY--THE LARGEST KARSTIC SPRING IN THE WORLD,
J. Karanjac, and G. Gunay.
Journal of Hydrology, Vol 45, No 3/4, p 219-231, February 1980. 5 Fig, 4 Ref.

Descriptors: *Springs, *Discharge(Water), *River flow, *Fluorescent dye, *Rhodamine, Tracers, Reservoir sites, Pre-impoundment, Karst, Base flow, Recession curves, Hydrographs, Limestones, Submergence, Aquifers, *Turkey.

The enormous Dumanli spring in the Mediterranean region of Turkey will be submerged by the

year 1982 by about 120 m head produced by the Oymapinar Reservoir. The spring contributes one-third to the annual discharge of the Manavgat River, which will be dammed at Oymapinar. The mean discharge of the spring is estimated at about 50 cu m/s; thus its total annual outflow is about 1.6 x 10 to the 9th power cu m. In October 1978 the authors measured the spring discharge by the dye-dilution technique. The flow rate of about 35.6 cu m/s at the very end of the dry period (at the end of the spring's discharge recession) motivated the authors to declare the Dumanli the largest karstic spring in the world, issuing from one single orifice. The results of the dye-dilution technique applied in this experiment were compared with staff-gage readings upstream and downstream of the Dumanli spring. To the best of the authors' knowledge this is the first reported dye-dilution experiment that accurately measured the discharge of a river with an annual flow of about 50 cu m/s. (Visocky-ISWS)
W80-04029

WATER RESOURCES OF THE LOWER ELWHA INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
K. L. Walters, W. L. Haushild, and L. M. Nelson.
Geological Survey Water-Resources Investigations 79-82 (open-file report), 1979. 54 p, 14 Fig, 6 Tab, 12 Ref.

Descriptors: *Groundwater resources, *Indian reservations, *Available water, *Potential water supply, Fish hatcheries, Hydrogeology, Data collections, Sites, Climatic data, Hydrologic data, Hydrologic cycle, Water wells, Logging(Recording), Water-level fluctuations, Aquifers, Flow characteristics, Water quality, Surface waters, Groundwater, Flooding, Water temperature, Washington, *Lower Elwha Indian Reservation(Wash), Clallam County(Wash), Elwha River(Wash).

The Lower Elwha Indian Reservation covers 372 acres at the mouth of the Elwha River in Clallam County, Washington. The land of the reservation is used principally for residential purposes and growing forage for cattle. The population of the reservation is largely dependent upon fisheries resources for its economic health. This study was made to assess the availability and suitability of ground water on the reservation for domestic use and for fish propagation, to determine the streamflow characteristics of the Elwha River and Bosco Creek, and to determine the chemical and physical quality of the area's surface and ground waters. Existing wells on the reservation range in depth from about 30 to about 80 feet, and produce water of excellent chemical quality. Properly constructed wells in favorable locations on the reservation should be capable of large yields up to 5,000 gallons per minute. Intrusion of seawater into the aquifers of the reservation has not occurred. However, if massive quantities of ground water are withdrawn, intrusion could occur. The Elwha River, which flows along the western margin of the reservation has a mean annual flow of about 1,500 cubic feet per second (cu ft/s). The recorded minimum daily discharge was 10 cu ft/s, and the maximum was 41,600 cu ft/s. The river floods the lower parts of the reservation annually, and extensive flooding is common. Water in the Elwha River is of excellent chemical quality, and its recorded temperature has ranged from 36F to 64F. Bosco Creek, the only other stream on or adjacent to the reservation, has an estimated mean annual flow of 1.1 cu ft/s. (Kosco-USGS)
W80-04086

GROUND-WATER RESOURCES IN THE METROPOLITAN REGION OF NASHVILLE, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
D. R. Rima, and P. L. Goddard.
Geological Survey report, 1979. 44 p, 6 Fig, 2 Plates, 6 Tab, 16 Ref. (Prepared in cooperation with U.S. Army Corps of Engineers, Nashville District).

Descriptors: *Groundwater resources, *Tennessee, *Groundwater availability, *Water resources development, *Water quality, Geomorphology, Hydrologic cycle, Hydrologic data, Water wells, Water analysis, Water yield, Aquifer characteristics, Limestones, Bedrock, Karst, Regolith, Subsurface flow, *North-central Tennessee, *Nashville(Tenn).

The availability of ground-water in a 10-county area in north-central Tennessee surrounding Nashville is reported. The Central Basin and Highland Rim physiographic regions equally comprise the study area. Records of wells and springs were analyzed to derive relationships between the availability of large ground-water supplies and maps depicting geologic and topographic features. In the Central Basin, significant features include the following: (1) depressions in bedrock structure; (2) low, flat areas; and (3) delineations of tops of four major aquifers. Significant features in the Highland Rim include the following: (1) regolith at least 60 feet thick; (2) depressions in bedrock structure; and (3) low, flat areas. The significant features in each region were used to prepare maps delineating areas of high, moderate, and low potential for the development of ground-water supplies. Large groundwater supplies are available in most of the study area. Yields of successful wells may range from 100 to 250 gallons per minute. (Kosco-USGS)
W80-04089

HYDROLOGIC DATA FROM SELECTED WELLS IN THE HELENA VALLEY, LEWIS AND CLARK COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. A. Moreland, R. B. Leonard, T. E. Reed, R. O. Clausen, and W. A. Wood.
Geological Survey open-file report 79-1676, November 1979. 54 p, 18 Fig, 1 Plate, 4 Tab.

Descriptors: *Hydrologic data, *Water wells, *Montana, *Data collections, *Groundwater, Aquifer testing, Test wells, Drawdown, Pumping, Observation wells, Water level fluctuations, Measurement, Water quality, Water analysis, Water temperature, Chemical analysis, Irrigation, Maps, *Helena Valley(Mont), *Lewis and Clark County(Mont).

Hydrologic data were collected during 1978-79 to aid in evaluating the hydrologic conditions in shallow aquifers beneath the Helena Valley, Montana. The locations of 52 shallow test wells augered during the study are shown on a map at a scale of 1:48,000. Periodic water-level measurements and water-quality analyses for the test holes are listed in tables. Water temperature, specific conductance, and nitrate concentration are given for water samples collected from 98 domestic wells, and chemical analyses are included for 11 domestic and irrigation wells. In addition, water-level drawdown and recovery data are plotted on graphs for five pumped wells and three observation wells. (Kosco-USGS)
W80-04090

GROUNDWATER IN THE UNITED STATES 1975-78,
Geological Survey, Lawrence, KS. Water Resources Div.
J. S. Rosenshein.
Review of Geophysics and Space Physics, Vol 17, No 6, p 1240-1253, September 1979. 354 Ref.

Descriptors: *Groundwater, *United States, *Water resources development, *Water quality, *Groundwater resources, Aquifer systems, Droughts, Evaluation, Surface waters, Conjunctive use, Saline water intrusion, Waste disposal, Water management(Applied), Pumping, Subsidence, Chemical analysis, Reclaimed water.

Interest in groundwater has been at a high level from 1975 to 1978. The study of environmental problems caused greater interest in the relation of groundwater to energy and resources development, water-quality surveillance, and the legal and economic significance of depleting aquifer systems during extended droughts. Increased interest has been shown by creation and implementation of the National Water Data Exchange, the Safe Drinking Water Act requirements, summary appraisals of groundwater regions, Regional Aquifer-System Analyses, State-Federal Water Use Data Base, and numerous water-management districts. Research in groundwater systems included quantitative and qualitative evaluation for planning and management, conjunctive use of ground and surface water, land- and water-use management, contamination by saltwater and waste disposal, subsidence related to pumping or dissolution of salt beds, and the chemical and biochemical effects of reclaiming waste water. Analytical models were used to solve problems in two- and three-dimensional flow, confined and unconfined systems, transient and steady-state conditions, saturated and unsaturated flow, and estimation of aquifer parameters. (Kosco-USGS)
W80-04094

GEOLOGY AND GROUNDWATER RESOURCES OF MONROE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. D. Carswell, and O. B. Lloyd, Jr.
Pennsylvania Geological Survey, Fourth Series, Water Resources Report 47, 1979. 61 p, 7 Fig, 1 Plate, 12 Tab, 46 Ref, Append.

Descriptors: *Groundwater resources, *Hydrogeology, *Aquifer characteristics, *Groundwater availability, *Water quality, Water wells, Water yield, Water level fluctuations, Pumping, Surface-groundwater relationships, Groundwater recharge, Water analysis, Chemical analysis, Pennsylvania, *Monroe County(PA).

Monroe County is on the eastern border of Pennsylvania, where average annual recharge to and discharge from the ground-water reservoir is about 17 inches. Recharge circulates to a depth of more than 800 feet, but 85 percent of the circulation in above 400 feet. Glacial deposits and the underlying clastic and carbonate rocks comprise the groundwater reservoir, which stores about one trillion gallons of freshwater. One of every four wells located, constructed, and developed for large yields can, on the average, produce 400 gal/min from coarse glacial deposits; more than 200 gal/min from the Bloomsburg Formation, Poplar Gap Member of the Catskill Formation, and the carbonates; about 100 gal/min or more from the noncarbonates of the Silurian-Devonian undivided unit, the Marcellus, and the Trimmers Rock Formations; and less than 100 gal/min from the Mahantango Formation and the other members of the Catskill Formation. (Kosco-USGS)
W80-04095

GEOHYDROLOGIC DATA FOR THE BEAVER-PASQUISET GROUND-WATER RESERVOIR, RHODE ISLAND,
Geological Survey, Providence, RI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04098

ANALYSIS OF CHANGES IN GROUNDWATER LEVELS IN A SEWERED AND AN UNSEWERED AREA OF NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
D. J. Sulam.
Ground Water, Vol 17, No 5, p 446-455, September-October 1979. 7 Fig, 4 Tab, 10 Ref.

Descriptors: *Mass curves, *Groundwater, *Water level fluctuations, *Sewerage, *New York, Drawdown, Pumping, Sewers, Cesspools, Septic tanks, Groundwater movement, Hydrographs, *Long Island(NY), Water level declines.

From the 1950's to the early 1970's, expansion of sanitary sewerage in southwest Nassau County, Long Island, N.Y., contributed to progressive declines in ground-water levels. Since the early 1970's however, 10 years after the area was fully

sewered, water levels have not declined significantly, which suggests that the water table may have reached a new equilibrium position. Double-mass-curve analyses show that during 1953-76 the average weighted ground-water levels in a 32-square-mile part of the sewered area declined 12.2 feet more than those in the unsewered area to the east. However, by 1973 this decline was 13.5 feet. Finite-difference digital-model results indicate that 3.6 feet of the relative 1953-76 decline was due to pumping in adjacent Queens County and that most of the remaining decline was a result of sewerage. Streamflow within the sewered area decreased in response to the lowered ground-water levels, and ground-water levels in the adjacent unsewered area were also lowered because of the sewerage. (Kosco-USGS)
W80-04099

INTERACTIONS OF MINING AND WATER RESOURCE SYSTEMS IN THE SOUTHEASTERN IDAHO PHOSPHATE FIELD,
Idaho Univ., Moscow. Dept. of Geology.
D. R. Ralston, T. D. Brooks, M. R. Cannon, T. F. Corbet, and H. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160385, Price codes: A11 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho. Research Technical Completion Report, September 1979. 229 p, 59 Fig, 19 Tab, 71 Ref. OWRT C-7651 (No 7253)(1).

Descriptors: *Idaho, *Base flow, *Groundwater, *Phosphates, *Water pollution sources, Subsurface flow, Hydrogeology, Hydrologic aspects, Aquifer characteristics, Waste disposal, Mathematical models, Environmental effects, Topography, Mining.

Hydrologic and mining related variables were identified and their interaction evaluated to promote effective resource development balanced with conservation management in the Western Phosphate Field located in Idaho, Utah, Wyoming, and Montana. Several phases were involved in the study: the delineation of hydrologic and mining related variables, data collection and analysis from selected sites in Idaho, and the construction of models showing variable interaction. Various groups of environmental factors interacting to shape the water resource systems in the area include: geologic, topographic, hydrologic, climatic, chemical, and biotic. Two mining activities, open pits and waste piles, were found to have the largest potential for affecting water resource systems. A study of stream gains and losses and the locations of springs confirmed a pattern of hydrogeologic characteristics, the 'phosphate sequence', which occurs throughout the area involving groundwater flow in the Dinwoody, Phosphoria, and Wells formations. Two mine areas were studied in detail to obtain additional hydrogeologic insight on flow patterns. Another study showed that chemical leaching and acid production from phosphate waste piles is not a problem. Conceptual models of water resource systems were developed from the theoretical patterns of groundwater flow. The models were used to classify potential mine sites and can be used to evaluate mining impacts on the water resource systems and the hydrologic limitations to mining. A predictive steady state model of the upper Blackfoot River basin was also developed. (Seigler-IPA)
W80-04104

2G. Water In Soils

FIELD MEASUREMENT OF SOIL HYDRAULIC PROPERTIES CHARACTERIZING WATER MOVEMENT THROUGH SWELLING CLAY SOILS,
Soil Survey Inst., Wageningen (Netherlands).
J. Bouma.
Journal of Hydrology, Vol 45, No 1/2, p 149-158, January 1980. 8 Fig, 14 Ref.

Descriptors: *Soil water movement, *Hydraulic properties, *Infiltration, *Expansive clays, Soil properties, Clays, Porous media, Heterogeneity, Cracks, Permeability, *Field measurements, Sampling techniques.

Determination of hydraulic properties in swelling clay soils is difficult due to seasonal variations in pore geometry and to soil structural heterogeneity, requiring large samples. Large in situ columns are therefore prepared to measure K sub sat and K sub unsat near saturation, using the crust test. Soil structure descriptions can be used to estimate optimal sample size. Infiltration into dry or moist clay soil with vertically continuous cracks involves preferential vertical movement of water along the cracks. The resulting irregular moisture distribution does not allow use of many common soil physical techniques, which require homogeneous moisture contents in isotropic soil. (Adams-ISWS)
W80-03935

ANALYTICAL SOLUTIONS FOR PREDICTING SOLUTE MOVEMENT AND THEIR INTERPRETATION IN RECLAMATION,
Central Soil Salinity Research Inst., Karnal (India).
S. K. Gupta, and S. R. Singh.
Journal of Hydrology, Vol 45, No 1/2, p 133-148, January 1980. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Leaching, *Saline soils, *Model studies, Mathematical models, Equations, Soil water, Soil water movement, Solutes, Salts, Dispersion, Soils, Reclamation, Soil science, Solute movement.

Analytical solutions to the dispersion-convection equation for leaching of saline soils under exponentially decreasing and arbitrary initial salt profile were presented. The soil profile was considered semi-infinite and homogeneous. Another solution incorporating and exponentially decreasing time-varying boundary condition at the surface was developed. The effect of the initial condition and solute transport parameters on the predictive behavior of the model was studied by arbitrarily choosing values of the parameters. The results indicated that the prediction accuracy of the model increases if the initial salt distribution profile is represented by a function which approximates this profile closely. The effect of the time-varying boundary condition is negligible for most practical purposes at or below 15 cm depth of the soil profile. The changes in the transport parameter may not only enhance or retard the pace of reclamation but also affect the final salt distribution in the soil profile. (Sims-ISWS)
W80-03936

CALCULATION OF WATER BALANCE IN THE CROP ROOT ZONE BY COMPUTER,
Indian Agricultural Research Inst., New Delhi. Water Technology Centre.
P. B. S. Sarma, N. H. Rao, and K. V. P. Rao.
Journal of Hydrology, Vol 45, No 1/2, p 123-131, January 1980. 5 Fig, 2 Ref, 1 Append.

Descriptors: *Water balance, *Root zone, *Model studies, Computer models, Mathematical models, Soil water, Soil moisture, Evaporation, Evapotranspiration, Rainfall, Irrigation, Subsurface drainage, Infiltration, Soil water movement, Storage, Computer programs, Computers, Soil science.

A computer program was developed that computes the daily evapotranspiration as a residue from the water balance equation. Moisture profiles from field observations of soil moisture tensions are used as an input into the model. Further, the program evaluates the effects of rainfall or irrigation during the periods of observation and also calculates the water loss from deep drainage. It takes care of the limitation in the availability of data due to occasional skipping of records for two or more days at a stretch. The additional features of this program include the procedures for the computation of infiltration and the moisture flow. The model was applied to actual field data, and the results were presented. (Sims-ISWS)
W80-03937

SOIL SPATIAL VARIABILITY AND ITS CONSEQUENCES ON SIMULATED WATER BALANCE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
M. L. Sharma, and R. J. Luxmoore.
Water Resources Research, Vol 15, No 6, p 1567-1573, December 1979. 6 Fig, 2 Tab, 20 Ref. DOE W-7405-eng-26.

Descriptors: *Soil properties, *Spatial distribution, *Water balance, *Model studies, Mathematical models, Hydraulic properties, Soils, Evapotranspiration, Vegetation, Vegetation effects, Runoff, Surface runoff, Subsurface runoff, Drainage, Precipitation(Atmospheric), Soil water, Groundwater, Storage, Watersheds(Basins), Hydrology.

Scaling theory, based on the similar media concept, provides a basis for representing soil spatial variability in terms of a single stochastic variable, the scaling factor alpha which is related to the microscopic characteristic length of the soil. Based on the measured properties of alpha (log normally distributed with an arithmetic mean of 1.0 and coefficient of variation of 0.6), the effects of soil spatial variability on the water balance components of a grassland watershed near Chickasha, Oklahoma, were studied by using a simulation model. Monthly simulations of evapotranspiration, surface runoff, deep drainage, and change in soil water storage for the year 1973 were computed for several values of alpha, representing soils with widely ranging hydraulic properties. At any time, vegetation and meteorological parameters were the same for all the soils. Our studies revealed the complexities of soil-plant-atmospheric interactions in evaluating the influence of soil variability on water balance and underlined the limitations of drawing generalizations. The conclusions were highly dependent on the extent of variability (coefficient of variation of alpha), the frequency distribution function of the scaling factor, and the soil-plant-weather combination. (Sims-ISWS)
W80-03947

MEASUREMENT AND NUMERICAL SIMULATION OF HYSTERETIC FLOW IN A HETEROGENEOUS POROUS MEDIUM,
Waterloo Univ., (Ontario). Dept. of Earth Sciences.
R. W. Gillham, A. Klute, and D. F. Heermann.
Soil Science Society of America Journal, Vol 43, No 6, p 1061-1067, November-December 1979. 10 Fig, 2 Tab, 20 Ref. OWRT A-014-COLO(4).

Descriptors: *Mathematical models, *Hysteresis, *Porous media, *Numerical analysis, *Heterogeneity, Hydraulic conductivity, Pressure head, Moisture content, Laboratory tests, Sands, Equations, Equipment, Richards equation, Sand column.

A finite difference solution of the Richards equation was tested experimentally for hysteretic flow in a nonuniform medium. The space-dependent hydraulic properties (water content-pressure head and hydraulic conductivity-water content) were determined experimentally on a laboratory column of sand and were represented in the numerical model by empirical equations. Boundary conditions resulting in hysteretic flow were applied to both the experimental column and the numerical model, and the resulting water content and pressure head profiles were compared. Agreement was excellent between the measured and computed results. An additional simulation, in which the medium was considered to be nonhysteretic, gave good agreement between the measured and computed pressure head values but resulted in substantial error in the computed water content values. (Visocky-ISWS)
W80-04023

THE APPLICATION OF THE GAMMA NEUTRON METHOD FOR TRANSPORT STUDIES IN FIELD SOILS,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-Les-Durance (France). Dept. de Biologie.
P. Couchat, P. Moutonnet, M. Puard, and F. Brissaud.
Water Resources Research, Vol 15, No 6, p 1583-1588, December 1979. 11 Fig, 3 Tab, 10 Ref.

Descriptors: *Nuclear moisture meters, *Soil water movement, *Tracers, *Deuterium, Equipment, Instrumentation, Laboratory tests, Gamma rays, On-site investigations, Moisture content, Soils, Soil moisture, Pore water, Soil science.

In order to study water movement in the field, deuterated water was monitored by the gamma neutron method, using 208T1 gamma source and 3He thermal neutron detector. A laboratory device was presented which supplies measurement data on a 5-ml soil solution. The performance of a gamma neutron probe was evaluated, the background count rate which depends on soil moisture content was related to the neutron emission of 208T1 gamma source, the resolution was found to depend on gamma diffusion and was no more than 15 cm in unsaturated soil, and the calibration was given vs. volumetric deuterated water content. The dispersive transport of a D20 pulse on a soil column was studied through a D20 concentration profile and breakthrough curve at the bottom of the column. Then simultaneous measurements of soil water content and D20 concentration by the neutron moisture gage and the gamma neutron probe enabled the authors to interpret the evolution of the D20 pulses as a function of irrigation during a field experiment. (Sims-ISWS)
W80-04032

EFFECTS OF CLEARCUTTING ON SOIL WATER DEPLETION IN AN ENGELMANN SPRUCE STAND,
Utah State Univ., Logan. Watershed Science Unit.
For primary bibliographic entry see Field 4A.
W80-04034

ESTIMATING SOIL WATER RETENTION CHARACTERISTICS FROM PARTICLE SIZE DISTRIBUTION, ORGANIC MATTER PERCENT, AND BULK DENSITY,
Science and Education Administration, St. Paul, MN. Soil and Water Management Research Unit.
S. C. Gupta, and W. E. Larson.
Water Resources Research, Vol 15, No 6, p 1633-1635, December 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Soil water, *Regression analysis, *Particle size, *Organic matter, *Retention, *Bulk density, Statistical models, Equations, Curves, Soil water movement, Soils, Soil-water-plant relationships, Sands, Silts, Clays, Soil water retention.

Regression models were presented for estimating soil-water-retention curves from particle-size distribution, percentage of organic matter, and bulk density. Models were developed from the measured soil-water-retention curves of artificially packed cores (7.6 x 7.6 cm) of 43 soil materials. These soil materials included 13 agricultural soils. Curves predicted with these models approximated reasonably well the measured water retention of 61 Missouri soils. Because conventional methods of obtaining retention curves are expensive and time consuming, these equations will be valuable for modeling salt and water flow in soils and for estimating available water capacities. (Visocky-ISWS)
W80-04038

SPATIAL VARIABILITY OF INFILTRATION IN A WATERSHED,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
M. L. Sharma, G. A. Gander, and C. G. Hunt.
Journal of Hydrology, Vol 45, No 1/2, p 101-122, January 1980. 13 Fig, 3 Tab, 34 Ref.

Descriptors: *Infiltration, *Correlation analysis, *Heterogeneity, *Watersheds(Basins), *Oklahoma, Analysis, Porous media, Soil properties, Soil physics, Infiltrometers, Unsteady flow, Statistical methods, Loam, *Philip's equation, *Silt loam soils, Field experiments, Log-normal distributions.

Twenty-six infiltration tests were carried out on a 9.6-ha watershed, near Chickasha, Oklahoma. The data from each test were expressed in the form of Philip's two-parameter equation. In most cases this equation could be adequately matched to the data so that the variability of infiltration in the watershed could be expressed in terms of the two parameters, S and A. There was no obvious pattern in the distribution of infiltration parameters with respect to soil type or position in the watershed. Due to large variability within soil units of the watershed, delineation of hydrologically homogeneous zones is not warranted. The range of values of S over the watershed was within an order of magnitude, while that of A was within two orders of magnitude. Parameters S and A were correlated (r = 0.81). The frequency distributions were better approximated by log-normal than by normal distributions. However, assuming a normal distribution for S would not introduce as much error as it would for A. The infiltration data from 26 sites, comprising 618 observations, were scaled according to the concept of similar media, and one value of scaling factor was assigned to the infiltration data of each site. Scaling factors alpha sub S and alpha sub A were computed from the independently determined parameters, S and A. The reduction in error sums of squares of the scaled data was much greater with alpha sub A than with alpha sub S, although the scaling theory states that these factors should be identical. Remarkable improvement in scaling was achieved when the geometric or the harmonic means were used. Results based on the harmonic mean of alpha sub SA were almost identical to those calculated by statistical optimization. The frequency distribution of scaling factors in the watershed was log-normal. (Adams-ISWS)
W80-04062

2H. Lakes

PHOSPHORUS DYNAMICS IN A PIEDMONT RESERVOIR,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
L. Greer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-156235, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, 1979, 85 p, 14 Fig, 16 Tab. OWRT-A-102-NC(1), 14-34-0001-9035.

Descriptors: *Phosphorus, Phosphorus uptake, Lake stratification, Nutrients, Turnovers, Bacterial uptake, *Reservoirs, Algae, Bacteria, Suspended solids, Lakes, North Carolina, *University Lake(NC), Piedmont, Phosphorus concentration, *Lake nutrients.

A North Carolina Piedmont lake was monitored for physical and chemical characteristics. Interest focused on phosphorus (P) and nitrogen concentrations, and phosphorus uptake by algae, bacteria and suspended sediments. Results indicate that phosphate concentrations from 0.006 mg/l to 0.045 mg/l constituted half and one quarter of the total P in winter and spring, respectively. Bacterial uptake exceeded algal uptake of P at all depths and on all occasions except June. Suspended sediment did not compete favorably with the 2 biotic components and contributed significantly to the uptake of P only during the winter. (DiNardi-NC)
W80-03908

PRELIMINARY OBSERVATIONS ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF ROSS BAY, A POLLUTED AREA OF LOUGH LEANE, SOUTH-WEST IRELAND,
University Coll., Dublin (Ireland). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-03934

TURBIDITY-INDUCED MEROMIXIS IN AN OREGON RESERVOIR: HYPOTHESIS,
Army Engineer District, Portland, OR. Hydrology Section.
D. W. Larson.
Water Resources Research, Vol 15, No 6, p 1560-1566, December 1979. 6 Fig, 1 Tab, 17 Ref, 1 Append.

Descriptors: *Reservoirs, *Meromixis, *Turbidity, *Oregon, Stratification, Water temperature, Suspended solids, Sediments, Lakes, Limnology, *Hills Creek Reservoir(OR).

Flood flows into a river impoundment early in its history are believed to have produced a deep-water layer of highly turbid water that persisted owing to the slow settling of suspended material and poor reservoir flushing ability. Subsequent inflows of considerably cleaner water, superimposed on the turbid layer, created a pronounced mid-depth density gradient. Possibly, circulation of water between the two layers was restricted for several years, and a condition regarded as meromictic may have been established. (Sims-ISWS)
W80-03948

CLIMATOLOGICAL ESTIMATE OF THE AVERAGE MONTHLY ENERGY AND WATER BUDGETS OF LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
L. O. Myrup, T. M. Powell, D. A. Godden, and C. R. Goldman.
Water Resources Research, Vol 15, No 6, p 1499-1508, December 1979. 11 Fig, 4 Tab, 35 Ref. NSF AEN 22675, NSF DES 75-14375, NSF GA-34099.

Descriptors: *Lakes, *Hydrologic budget, *Energy budget, *California, *Nevada, Water temperature, Air temperature, Meteorological data, Hydrologic data, Runoff, Precipitation(Atmospheric), Discharge(Water), Evaporation, Analytical techniques, Monthly, Analysis, Mathematical models, Lake Tahoe, Limnological data.

An estimate of the average monthly energy and water budgets of Lake Tahoe, California-Nevada, was made from commonly available meteorological, hydrological, and limnological data. The water budget indicates that precipitation, discharge, runoff, and evaporation dominate the water balance in seasonal succession, each associated with an appropriate minimum or maximum in the lake water storage. The annual energy budget is dominated by the net radiation and evaporation terms with 93% of the radiation input used to evaporate water. The seasonal energy budget indicates that (1) energy storage is in phase with the radiation input and is a dominant term in the periods November-January and May-July, (2) evaporation reaches a maximum value in the fall, 3 months after the radiation maximum, (3) upward transfer of sensible heat from the lake surface reaches a maximum another 3 months later, in the winter, and (4) the sensible heat flux is downward in late spring and early summer, indicating stable stratification in the atmospheric surface layer over the lake during this period, a result of possible significance to air quality in the Tahoe basin. The energy storage and sensible heat transfer terms show large fluctuations in the fall which may be associated with large-scale meteorological events during a season in which energy is trapped in the surface waters by stable stratification in the thermocline layer. (Humphreys-ISWS)
W80-03953

USE OF HYPOLIMNETIC OXYGEN DEPLETION RATE AS A TROPHIC STATE INDEX FOR LAKES,
Meta Systems, Inc., Cambridge, MA.
W. W. Walker, Jr.
Water Resources Research, Vol 15, No 6, p 1463-1470, December 1979. 11 Fig, 3 Tab, 24 Ref.

Descriptors: *Lakes, *Water quality, *Dissolved oxygen, *Indicators, Hypolimnion, Trophic level, Eutrophication, Phosphorus, Chlorophyll, Turbidity, Nutrients, Oxygen, Data processing, Analytical techniques, Limnology.

The feasibility of lake water quality management planning has been greatly increased over the past 10 years with the development of relatively simple, empirical methods for assessing eutrophication problems. These relate phosphorus loading, hydrology, and morphometry to such traditional tro-

phic state indices as phosphorus concentration, chlorophyll-a concentration, and transparency. One of the difficulties associated with use of these methods is that water quality criteria, as related to beneficial use, do not generally correspond to subjective definitions of 'trophic state.' This paper attempted to improve upon existing methods by relating measures of phosphorus, chlorophyll-a, and/or transparency to hypolimnetic dissolved oxygen, which is of direct relevance to existing water quality standards, particularly for fisheries management. A modified version of Carlson's trophic state index summarized relationships among summer, epilimnetic measurements of total phosphorus, chlorophyll-a, and transparency. On the basis of data from 30 lakes this index was shown to be highly correlated with areal hypolimnetic oxygen depletion rate when the apparent effects of mean depth were also taken into account (R sq = 0.91). Tests of the empirical model on a separate data base of 86 lakes indicated that the approach can be used to predict oxygen status based upon lake morphometry and trophic index. The methodology provided a link between phosphorus mass balance models and existing water quality criteria for dissolved oxygen. (Sims-ISWS)
W80-03954

FEATURES OF THE STRUCTURE AND TROPHIC LINKS OF PLANKTONIC ASSOCIATIONS IN TWO LAKES WITH DIFFERNET DEGRESS OF SALINITY,
Akademiya Nauk SSSR, Moscow. Inst. of Limnology.
For primary bibliographic entry see Field 5C.
W80-03963

ICHTHYOPLANKTON OF THE ST. LAWRENCE ESTUARY: COMPOSITION, DISTRIBUTION, AND ABUNDANCE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
K. W. Able.
Journal of the Fisheries Research Board of Canada, Vol 35, No 12, p 1518-1531, December 1978. 13 Fig, 6 Tab, 45 Ref.

Descriptors: *St Lawrence estuary(Canada), *Distribution, *Biomass, *Fish eggs, Plankton, Larvae, Larval growth stage, Fish, Fish establishment, Osmerids, Gadids, Cottids, Cyclopterids, Pleuronectids, Smelts, Spawning, Speciation, Systematics, Spatial distribution, Seasonal, Baseline studies, Canada.

Ichthyoplankton composition, distribution and abundance in the St. Lawrence estuary, including the adjacent Saguenay River and the northwest Gulf of St. Lawrence, were investigated June-July 1973, June-October 1974, and May-September 1975. Estuarine ichthyoplankton are relatively depauperate. Eggs and larvae of 25 species from 14 families were collected; gadid, cottid, cyclopterid and pleuronectid families had the most species. Most abundant larvae were osmerids, capelin (Mallotus villosus) and rainbow smelt (Osmerus mordax), which together made up 91.2%, 87.9% and 98.8% respectively of total larvae collected 1973-1975. Larvae were dominated by species with demersal eggs. Pelagic eggs occurred; however, these were usually from nonresident species. During all 1975 sampling periods, larvae were consistently more abundant in the upper than lower estuary. Larval abundance varied 1.4-860.3 individuals/100 cu m in the upper estuary compared with 0.1-1.0 individuals/100 cu m in the lower estuary. Greater larval abundance in the upper estuary is due to its use as a major spawning (M. villosus, Clupea harengus harengus) and nursery area (C. harengus harengus, O. mordax, Microgadus tomcod). Pelagic eggs and fish larvae are most abundant late May to early June with 99.4% of all larvae taken in early June. (Danovich-Wisconsin)
W80-03965

MULTIOBJECTIVE DYNAMIC PROGRAMMING WITH APPLICATION TO A RESERVOIR,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W80-04025

MULTIOBJECTIVE DYNAMIC PROGRAMMING: A CLASSIC PROBLEM REDRESSED,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W80-04026

RELIABILITY-CONSTRAINED RESERVOIR CONTROL PROBLEMS, 1. METHODOLOGICAL ISSUES,
IBM Thomas J. Watson Research Center, Yorktown Heights, NY.
M. Sniedovich.
Water Resources Research, Vol 15, No 6, p 1574-1582, December 1979. 2 Fig, 1 Tab, 19 Ref.

Descriptors: *Reservoirs, *Reservoir operation, *Reliability, *Model studies, Mathematical models, Analytical techniques, Methodology, Reservoir storage, Reservoir releases, Dynamic programming, Computer models, Computer programs.

A dynamic programming solution procedure was developed for a class of reliability-constrained reservoir control problems associated with constraints defined over the entire life of the reservoir. Certain methodological issues involved in the modeling, analysis, and solution of reservoir control problems were raised, and it was shown how the proposed model can be used to evaluate heuristic release strategies. A simple numerical example was presented. (Sims-ISWS)
W80-04031

ON THE PROBLEM OF DISCRETIZATION IN DAM THEORY,
Caulfield Inst. of Tech., Victoria (Australia).
P. Lochert, and R. M. Phatarfod.
Water Resources Research, Vol 15, No 6, p 1593-1597, December 1979. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Reservoirs, *Reservoir operation, *Model studies, Mathematical models, Markov processes, Dams, Reservoir releases, Reservoir storage, Inflow, Discharge(Water), Theoretical analysis, Analytical techniques, Probability, Water resources, Discretization, Erlangian inputs, Reservoir theory.

This paper considered the twin problems of the nature of discretization and the size of the unit of discretization in reservoir theory. It compared the probabilities of emptiness and of fullness of the reservoir obtained by the discretization schemes suggested by Moran and Doran. It was proved that the probability of emptiness for the former scheme is always greater than that obtained for the latter scheme. The probability distribution of the reservoir content for the latter scheme was derived for the case when the release is the unit of measurement. Finally, the probabilities of emptiness and of fullness of the reservoir for the two schemes were compared with the exact values for the Erlangian input case. (Sims-ISWS)
W80-04033

THE LINEAR RESERVOIR WITH MARKOVIAN INFLOWS,
Ain Shams Univ., Cairo (Egypt).
A. A. Anis, E. H. Lloyd, and S. D. Saleem.
Water Resources Research, Vol 15, No 6, p 1623-1627, December 1979. 1 Fig, 1 Tab, 27 Ref.

Descriptors: *Reservoirs, *Inflow, *Discharge(Water), *Model studies, Mathematical models, Markov processes, Stochastic processes, Probability, Storage, Theoretical analysis, Analytical techniques, Hydrology, Reservoir theory.

The purpose was to derive the outflow distribution from a linear reservoir fed by a discrete-time gamma-distributed Markovian inflow. A satisfactory continuous time solution was available for the linear reservoir when the inflow distribution has independent increments. For the case of nonindependent increments discussed in the paper the treatment is in terms of a gamma-distributed Markov chain inflow process in discrete time, for which the Laplace transform of the outflow rate distribution was derived. This was inverted, numerically, for a set of typical parameter values. (Sims-ISWS)
W80-04035

A NOTE ON ERROR ANALYSIS FOR A PHOSPHORUS RETENTION MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow, and S. C. Chapra.
Water Resources Research, Vol 15, No 6, p 1643-1646, December 1979. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Lakes, *Phosphorus, *Limnology, *Michigan, Water quality, Model studies, Analytical techniques, Statistical methods, Mathematical models, Correlation analysis, Variability, Risks, *Lake Charlevoix(MI), Error analysis.

A statistical technique proposed for the estimation of the uncertainty in the prediction of phosphorus concentration in lakes using the Dillon-Rigler-Kirchner model can increase the practical value of this and similar models. The usefulness of this technique can be seen in its application to Lake Charlevoix, Michigan. But there are limitations on the use of this procedure, such as those that relate to model and data uncertainty. The technique described yields only an approximation of prediction uncertainty. This technique does have limitations, and they are as follows: (1) The phosphorus model is based on the assumption of a completely mixed lake. Thus the predicted phosphorus concentration is a spatial and temporal average value. This means that the prediction uncertainty refers to the uncertainty in the prediction as an estimate of the average value; it does not reflect any spatial and temporal variability in an application lake. (2) An empirical model like that proposed by Kirchner and Dillon should not be applied outside the range of conditions represented by the model development data set without prior verification. This constraint on the application of the model is important because the Kirchner-Dillon data set is fairly homogeneous and therefore not representative of the population of north temperate lakes. As a result of this homogeneity, the prediction uncertainty derived from the data probably is an underestimation of total uncertainty when applied to lakes outside the bounds of the data set. (See also W75-08970 and W75-08986) (Humphreys-ISWS)
W80-04040

NUTRIENTS LIMITING PHYTOPLANKTON PRODUCTION IN ICE-COVERED LAKE ST. CLAIR,
Windsor Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-04051

SEDIMENT MIXING BY LAMPSILIS RADIATA SILIQUOIDEA (MOLLUSCA) FROM WESTERN LAKE ERIE,
Case Western Reserve Univ., Cleveland, OH. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2J.
W80-04053

PHOSPHATE CHARACTERISTICS AND BIOAVAILABILITY OF SUSPENDED SEDIMENTS FROM STREAMS DRAINING INTO LAKE ERIE,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 5B.
W80-04054

APPLICATION OF SHORT-TIME SCALE RECORDING METER DATA TO NUMERICAL MODELLING OF TORONTO HARBOUR,
Ontario Ministry of the Environment, Toronto.
For primary bibliographic entry see Field 5B.
W80-04057

VOLATILE CHLORO- AND CHLOROFLUOROCARBONS IN LAKE ERIE--1977 AND 1978,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-04058

RELATIONSHIPS BETWEEN BACTERIAL POPULATIONS AND OXYGEN LEVELS IN THE CENTRAL BASIN OF LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
S. S. Rao, and A. A. Jurkovic.
Journal of Great Lakes Research, Vol 5, No 2, p 225-228, 1979. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Bacteria, *Dissolved oxygen, *Lake Erie, Hypolimnion, Epilimnion, Lakes, Microbiology, Carbon, Oxygen, Nitrogen, Water temperature, Sampling, Data processing, Limnology, Heterotrophic bacteria.

Studies were made to ascertain the relationships between bacteria and particulate organic carbon, particulate nitrogen, and the depletion of oxygen from the hypolimnetic waters of the central basin of Lake Erie. Heterotrophic bacterial populations, dissolved oxygen, particulate organic carbon, and total particulate nitrogen were determined during May, August, and September. Data indicated (1) a relationship between heterotroph populations and dissolved oxygen; (2) epilimnion oxygen concentrations of 9 mg/l were associated with bacterial levels of approximately 4000 colonies per ml; (3) bacterial densities started to increase from the thermocline downward; (4) hypolimnion oxygen levels of approximately 1 mg/l were associated with bacterial densities of approximately three times the epilimnion values; (5) bacterial oxygen uptake rate in the hypolimnion varied from 1.5 to 7.4 x 10 to the minus 10th power mg/l/hr; (6) particulate organic carbon and bacteria showed similar distribution patterns in the water column; (7) particulate nitrogen remained unchanged at 0.1 mg/l in the water column showing no relationship to the other parameters measured. (Sims-ISWS)
W80-04059

CHEMICAL AND BIOLOGICAL QUALITY OF SELECTED LAKES IN OHIO - 1976 AND 1977,
Geological Survey, Columbus, OH. Water Resources Div.
R. L. Tobin, and J. D. Youger.
Geological Survey Water-Resources Investigations 78-109 (open-file report), September 1979. 291 p, 77 Fig, 144 Tab, 49 Ref.

Descriptors: *Ohio, *Lakes, *Limnology, *Water quality, *Lake morphology, Data collections, Thermal stratification, Water chemistry, Nutrients, Phytoplankton, Algae, Bacteria, Pesticides, Anaerobic conditions, Dissolved solids, Dissolved oxygen, Cations, Anions, Light penetration, Secchi disks, Inflow.

Twenty-eight Ohio lakes (14 per year) were evaluated in 1976 and 1977 for water-quality status. Spring and late summer data included physical and profile measurements for a broad spectrum of chemical and biological constituents. Secchi disk transparency ranged from 0.2 to 6.4 meters. Seasonal thermal gradients occurred in all lakes deeper than 5.2 meters and not controlled by subsurface release values. Anaerobic conditions, and high concentrations of ammonia, carbon dioxide, and hydrogen sulfide, developed in all lakes having stable thermal gradients. Maximum dissolved oxygen was measured at 17.8 milligrams per liter (220 percent saturation) in Summit Lake. Calcium, bicarbonate, and sulfate were the principal constituents. Specific conductance varied from 130 to 1250 micromhos. Pesticides residues were not detected and concentrations of trace metals were within State limits. Fecal coliform bacteria counts were generally low and within State standards. Blue-green algae dominated the phytoplankton communities in 18 lakes in spring and 26 lakes in summer. The maximum algal count was 3,400,000 cells per millimeter in Kiser Lake, and algal counts were above 100,000 cells per milliliter in 19 lakes. (Kosco-USGS)
W80-04087

HYDROGEOLOGY AND COMPUTER MODEL OF THE BASS LAKE AREA, ST. CROIX COUNTY, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Geology and Geophysics.
M. B. Rinaldo-Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-163660, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, 1978. 95 p, 26 Fig, 3 Tab, 20 Ref. OWRT A-075-WIS(2), 14-34-0001-8053.

Descriptors: *Water level fluctuations, *Lakes, *Dams, *Hydrogeology, *Groundwater movement, Model studies, Groundwater recharge, Inflow, Evaluation, Wisconsin, *Bass Lake(Wisc), *Mounds Pond(Wisc), St. Croix County(Wisc).

Bass Lake is one of several lakes in northern Wisconsin where high water levels in the early 1970's caused flooding of roads and homes. Because Bass Lake is a ground-water dominant lake with no inlet or outlet, it was speculated that high water levels were caused by increased ground-water discharge to the lake brought about by an impoundment, Mounds Pond, on the Willow River. The impoundment is located 1.5 miles to the south and is 12 feet higher than the normal elevation of Bass Lake. In order to determine the probable cause of the high lake levels, an investigation into the hydrogeology of the area was initiated in the field and utilizing the Trescott-Pinder-Larson (1976) computer model to simulate the effects on the lake elevation of changing various parameters. Bass Lake appears to be influenced by a regional flow-through system and a local recharge system in the southern part of the lake and a regional flow-through system in the northern part of the lake. Results of the field study indicate that there is no ground-water flow between Mounds Pond and Bass Lake. Furthermore, computer model simulations indicated that lowering Mounds Pond 10 feet, as had been suggested as a means of alleviating the flooding at Bass Lake, would have no effect on Bass Lake levels. Computer model simulations using an increase in recharge rate and climatological data indicate that an increase in precipitation caused the abnormally high lake levels observed during the early 1970's.
W80-04111

MULTIDATE LANDSAT LAKE QUALITY MONITORING PROGRAM,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 7B.
W80-04118

PRODUCTION OF VITAMIN B12, THIAMINE, AND BIOTIN BY FRESHWATER PHYTOPLANKTON,
Kochi Univ. (Japan). Faculty of Agriculture.
J. Nishijima, R. Shiozaki, and Y. Hata.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 2, p 199-204, January 1979. 2 Fig, 3 Tab, 27 Ref.

Descriptors: *Phytoplankton, *Cultures, *Vitamin B, *Primary productivity, *Lake Kojima(Japan), Laboratory tests, Vitamins, Biochemistry, Metabolism, Nutrients, Eutrophication, Chlorophyta, Scenedesmus, Chlorella, Chlamydomonas, Growth stage, Speciation, Growth rates, Age, Japan.

Results of anexic cultures of several freshwater phytoplankton species from Lake Kojima, a eutrophic lake in Japan, suggest that some phytoplankton may significantly contribute to the production of dissolved B-group vitamins found abundantly in the lake. Phytoplankton were isolated from Lake Kojima on 24 April 1972; species include Scenedesmus, Chlorella, Chlamydomonas, Carteria and Chroococcus. Phytoplankton require no vitamins for growth; however, Carteria growth is partially depressed in vitamin-free medium. Thiamine stimulates Carteria growth in early incubation periods. Phytoplankton synthesize and secrete considerable amounts of the B-group vitamins increasingly with culture age. In general, all species except Chroococcus produce biotin, thiamine and B12 in order of concentration in the culture media: biotin 750-4,000 pg/ml medium, thiamine 0-3,400 pg/ml medium and vitamin B12 0.3-20 pg/ml medium after incubation for 17 days. B-group vitamins are generally produced increasingly with culture age over the whole experiment period; however, thiamine production by Carteria begins at the start of the stationary growth phase and increases a little with culture age. Values are mostly as follows: vitamin B12, 100-10 micro pg/cell/d; thiamine 1.0-0.1 micro pg/cell/d (except for Chlamydomonas and Carteria during early log phase); and biotin, 100-10 milli pg/cell/d (except for Chroococcus with 1.0-0.1 nano pg/cell/d). Vitamin production abilities vary with phytoplankton species, growth stage and other growth conditions. (Danovich-Wisconsin)
W80-04169

2I. Water In Plants

URBAN LAWN EVAPOTRANSPIRATION--MEASUREMENT AND PREDICTION,
Pool (Charles) and Associates, Inc., Ketchikan, AK.
For primary bibliographic entry see Field 2D.
W80-04021

SKELETONEMA POTAMOS (WEBER) HASLE AND CYCLOTELLA ATOMUS HUSTEDT (BACILLARIOPHYCEAE) IN THE PLANKTON OF RIVERS IN ENGLAND AND FRANCE,
Institute of Terrestrial Ecology, Cambridge (England); and Culture Centre of Algae and Protozoa, Cambridge (England).
J. H. Belcher, and E. M. F. Swale.
British Phycological Journal, Vol 13, No 2, p 177-182, June 1978. 7 Fig, 16 Ref.

Descriptors: *Diatoms, *Rivers, *Speciation, *England, *France, Plankton, Salinity, Distribution, Analytical techniques, Cytological studies, Microscopy, Size.

This paper is the first report on the occurrence of Skeletonema potamos and Cyclotella atomus in several localities in England and one in France. S. potamos occurred in May 1977 as a minor plankton component from Don River, Yorkshire, and in August 1977 from a tributary of River Colne, Gosfield, Essex. This species was also present in water from River Seine, Paris, France, August 1977. S. potamos forms short filaments of 2-4 cells, each 3-4 micro m wide and 6-10 micro m long sometimes with valves of adjacent cells in contact. Valve centers are flat but have a bevelled edge, so that V-shaped grooves are seen around cell contact areas. Cyclotella atomus was collected from the same river samples as S. potomas, from Trent River near Newark, Nottinghamshire in May 1977 and also from the Thames River at London Bridge in November 1977 in brackish water with 1 ppt salinity. Cells are cylindrical, 3.5-7.0 micro m in diameter. Valve faces are almost flat, but undulate slightly while edges are steeply angled. Frustules have marginal striae surrounding a plainer central area with a single off-center punctum, visible by light microscopy and appearing as a strutted process in electron microscopes. Both species live primarily in freshwater, though have halophilic tendencies. Both are small and could easily be overlooked if present in low numbers. S. potamos has a delicate wall, apt to disintegrate with normal cleaning and mounting procedures and is best recognized alive. (Danovich-Wisconsin)
W80-04120

VOLATILE ORGANIC SULFIDES FROM FRESHWATER ALGAE,
Washington State Univ., Pullman. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-04128

PRIMARY PRODUCTION OF ALGAE GROWING ON NATURAL AND ARTIFICIAL AQUATIC PLANTS: A STUDY OF INTERACTIONS BE-

TWEEN EPIPHYTES AND THEIR SUBSTRATE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
A. Cattaneo, and J. Kalff.
Limnology and Oceanography, Vol 24, No 6, p 1031-1037, November 1979. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Primary productivity, *Lake Memphremagog, Quebec-Vermont, *Macrophytes, *Artificial substrates, *Algae, *Epiphytes, Potamogeton richardsonii, Sampling, Biomass, Aquatic plants, Competition, Substrates, Plant growth, Nutrient requirements, Phosphorus, Symbiosis, Limiting factors, Nutrients, Hosts.

Epiphytes growing ion Potamogeton richardsonii and similar plastic plants in Lake Memphremagog, Quebec-Vermont, during 1976-1977 growing seasons, were similar in biomass and primary production, giving little support to hypothesized symbiosis or competition between plant and epiphytes. P. richardsonii is probably a neutral substrate for epiphytes, whose primary function is to provide epiphytes with suitable support sufficiently high in the water column. However, some interaction between host plants and epiphytes do take place, although they are not reflected by growth and biomass rates. Lower alkaline phosphatase activity of epiphytes growing on natural plants suggests that these algae are less P-limited than those growing on plastic plants and which obtain P from lining macrophytes. Epiphytes growing on plastic leaves offset loss of the macrophytic P source through increased alkaline phosphatase activity. Algae do not experience significant benefit or detriment in terms of growth or biomass by growing on a common macrophyte. Significant interactions between epiphytes and macrophytes should not be automatically assumed. (Harris-Wisconsin)
W80-04131

UPTAKE AND RELEASE OF NUTRIENTS BY AQUATIC MACROPHYTES,
Mankato State Univ., MN. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-04136

DISTRIBUTION AND ASPECTS OF THE PRODUCTION AND BIOMASS OF EELGRAS, ZOSTERA MARINA L., AT ROSCOFF, FRANCE,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
R. P. W. M. Jacobs.
Aquatic Botany, Vol 7, No 2, p 151-172, October 1979. 9 Fig, 3 Tab, 53 Ref.

Descriptors: *Biomass, *Macrophytes, *Roscoff, France, *Primary productivity, *Marine algae, Leaves, Seasonal, Intertidal areas, Turnovers, Rhizomes, Standing crops, Littoral, Tides, Tidal effects, Distribution, Temporal distribution, Growth rates, Spatial distribution, Depth.

At Roscoff, France, Zostera marina (eelgrass) grows to a depth of 4 m below MLWS in sandy bottoms, since all abiotic key parameters except light are consistent throughout this depth, light is the factor most likely responsible for eelgrass lower depth limits. Upper Z. marina limits are influenced by the time of water coverage and dessication. Aboveground biomass, leaf length, number of shoots/sq m correlates with time of water coverage. Biomass and production were measured February 1976-1977. Production was measured by a leaf marking technique together with determination of plastochrone interval, the time interval between the initiation of two successive leaves. Annual production is 1608 g dwt/sq m, maximum leaf biomass 257 g dwt/sq m and maximum total biomass 470 g dwt/sq m. The ratio of net annual production to maximum leaf biomass is 6.3 and that to maximum total biomass 3.4. Total biomass increases from February (190 g dwt/sq m), reaches maximum in August and declines in autumn and winter. Average turnover time for leaves is 68 days and for rhizomes 193 days, indicating that turnover rate of aboveground parts (1.5%/d) is higher than of underground parts (0.5%/d). Average plastochrone interval from April-October is 15.6 days; the mean for the whole year is 19.3 days. A survey on changes in the eelgrass beds since 1909 is also given. (Danovich-Wisconsin)
W80-04137

PHOSPHATASE ACTIVITY AND ITS ROLE IN THE MINERALIZATION OF ORGANIC PHOSPHORUS IN COASTAL SEA WATER,
Tokyo Univ. (Japan). Ocean Research Inst.
For primary bibliographic entry see Field 5F.
W80-04141

GROWTH, CHLOROPHYLL AND MINERAL NUTRIENT STUDIES ON PHALARIS ARUNDINACEAE L. IN THREE SCOTTISH LOCHS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W80-04147

2J. Erosion and Sedimentation

TURBIDITY-INDUCED MEROMIXIS IN AN OREGON RESERVOIR: HYPOTHESIS,
Army Engineer District, Portland, OR. Hydrology Section.
For primary bibliographic entry see Field 2H.
W80-03948

IMPACT OF ROAD NETWORKS ON SOUTHEASTERN MICHIGAN LAKESHORE DRAINAGE,
Michigan Univ., Ann Arbor. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-03951

SOURCES OF SEDIMENT INDUCED REDUCTIONS IN WATER QUALITY APPRAISED FROM CATCHMENT ATTRIBUTES AND LAND USE,
For primary bibliographic entry see Field 4D.
W80-03967

SEDIMENT MIXING BY LAMPSILIS RADIATA SILIQUOIDEA (MOLLUSCA) FROM WESTERN LAKE ERIE,
Case Western Reserve Univ., Cleveland, OH. Dept. of Earth Sciences.
P. L. McCall, M. J. S. Tevesz, and S. F. Schwelgien.
Journal of Great Lakes Research, Vol 5, No 2, p 105-111, 1979. 4 Fig, 39 Ref. EPA R805716010.

Descriptors: *Sediments, *Mixing, *Benthic fauna, *Mollusks, *Lake Erie, Laboratory tests, On-site investigations, Suspended solids, Moisture content, Oxygen, Lakes, Biology, Limnology, Bivalves, Unionids, Sediment mixing, Mollusks burrowing.

The sediment reworking activities of an abundant Lake Erie unionid bivalve, Lampsilis radiata siliquoidea, were studied by field observations and laboratory experiments. Unionid burrowing in laboratory microcosms increased sediment water content 10-20%, decreased water content variability, homogenized sedimentary structures, and increased tenfold the volume of oxidized sediment over that in microcosms with no unionids. Incomplete mixing of sediment took place to a depth of 10 cm during burrowing by L.r. siliquoidea. Burrowing by other unionids may extend the depth of maximum reworking to 20 cm. Unionid burrowing, feeding, and respiratory activities may alter the profiles of various elements and radionuclides associated with sediment particles and alter the location and intensity of microbial activity in sediments. (Sims-ISWS)
W80-04053

ON THE THRESHOLD OF TRANSPORT OF SAND-SIZED SEDIMENT UNDER THE COMBINED INFLUENCE OF UNIDIRECTIONAL AND OSCILLATORY FLOW,
University Coll. of Swansea (Wales). Dept. of Oceanography.
T. M. Hammond, and M. B. Collins.
Sedimentology, Vol 26, No 6, p 795-812, December 1979. 10 Fig, 1 Tab, 40 Ref.

Descriptors: *Sediment transport, *Laboratory tests, *Sedimentology, *Testing procedures, Cohesionless soils, Methodology, Sediments, Movement, Sands, Currents(Water), Velocity, Streambeds, Waves(Water), Beds, Flow, Open channels, Incipient motion, Oscillatory flow, Flat beds, Critical velocity.

While the transport of sediment by unidirectional currents or by oscillatory (wave-induced) currents has been investigated, very little attention has been paid to the problem of the threshold of transport under the two mechanisms combined. Studies were carried out using cohesionless sand-sized (mean diameters: 142, 363, 771, and 1134 micrometer) quartz grains in a unidirectional flume, within which an oscillatory carriage had been installed. The experiments were carried out under unidirectional velocities ranging between 0 and 27 cm/s, combined with simulated wave-induced currents (at periods of 5 and 15 s) ranging from 0 to 35 cm/s. The threshold of transport was assessed, by visual observation, using the Yalin Criterion for unidirectional flow. This criterion permitted critical conditions to be estimated subjectively by observation of incipient transport from the flat beds. The results indicated the dependence of the critical threshold velocity combination on grain size and wave period. Thresholds tend to increase with increasing grain size or decreasing period. The grain-size dependence is predictable from existing empirical relationships for the separate mechanisms; statistical fluctuations in near-bed stress (bursting), however, are invoked to explain the wave period dependence. The latter effect acts in a reverse manner for wave and current combinations than for waves alone. Graphs are presented, relating grain size to critical threshold velocity combinations, to aid in the sedimentological interpretation of field data. (Humphreys-ISWS)
W80-04060

WAVE-INDUCED LIQUEFACTION: A MODERN EXAMPLE FROM THE BAY OF FUNDY,
McMaster Univ. Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2L.
W80-04061

IMPACT OF NONPOINT POLLUTION CONTROL ON WESTERN LAKE SUPERIOR, RED CLAY PROJECT, FINAL REPORT: SUMMARY,
Environmental Protection Agency, Chicago. IL. Great Lakes National Program Office.
S. C. Andrews, D. S. Houtman, and W. J. Lontz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 200, Price codes: A03 in paper copy, A01 in microfiche. Report EPA 905/9-79-002. January 1979. 32 p, 5 Fig, 4 Tab.

Descriptors: *Nonpoint pollution, *Erosion control, *Lake Superior, *Sedimentation, *Water pollution, *Water pollution sources, *Erosion, Water quality, Water quality control, Water management(Applied), Nutrient loading, Turbidity, Slope stability, Land management, Soil loss, Vegetation effects, Monitoring.

This is the final document of the Red Clay Project, established in May 1974 under an EPA grant to demonstrate new methods for improving water quality in the Great Lakes. The focus of this project was the identification of nonpoint sources of pollution in the Western Lake Superior region. The area's predominant soils are red clays interspersed with sands and silts and are easily erodable. Major nonpoint sources of pollution are lakeshores, streambanks, and other slopes. The Red Clay project was a cooperative Federal-local research and demonstration project established to seek practical solutions to the red clay erosion and resulting water quality problems. The study area was divided into five geographical subdivisions representative of conditions in the entire water-

shed. Studies were undertaken of the condition and behavior of soils within the red clay area in order to utilize available sampling and testing techniques and opportunities to determine areas in which massive slope failure normally occurs. Researchers found that the use of vegetation was significant in erosion control. Red clay turbidity and sedimentation does not add to nutrient loads or oxygen levels in Lake Superior. Possible land management practices are presented. Monitoring of water quality and erosion were conducted at 13 stations, as well as monitoring of rainfall and temperature. Recommendations included keeping a common focus in multiple agency programs, providing cost sharing in nonpoint source pollution management efforts, identification of critical areas through preparation of conservation plans, using a voluntary compliance approach wherever possible, minimizing stream channel deepening, and using streambank vegetative cover wherever possible. A framework is presented for local management agency implementation of project recommendations. (Arnold-NC)
W80-04181

2K. Chemical Processes

EVALUATION OF LIMESTONE NEUTRALIZATION OF ACIDIC ADIRONDACK SURFACE WATERS,
Cornell Univ., Ithaca, NY.
J. J. Bisogni, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158561, Price codes: A03 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell University Research Project Technical Completion Report, March 1980. 26 p, 4 Fig, 5 Tab, 10 Ref. OWRT-A-083-NY(1), 14-34-0001-8034 and 9034.

Descriptors: *Surface waters, Acid neutralization, Acid precipitation, *Acidity, *Neutralization, *Limestones, New York, *Adirondack region(NY), Evaluation, Geochemistry, Water chemistry.

This research project evaluated the use of limestone in packed bed reactors to neutralize acidified Adirondack surface waters (particularly streams). The project was composed of two phases: investigation of sediment-water interactions and evaluation of the kinetics of limestone packed bed reactor neutralization. Experimental results demonstrated that there is little sediment water interaction with regard to hydrogen ion in the Adirondack lakes and streams studied. The results also demonstrated that neutralization of acidified Adirondack surface water by limestone packed bed reactors is feasible. A preliminary design procedure is presented to show this feasibility.
W80-03961

ANALYTICAL METHOD FOR NONIONIC SURFACTANTS IN LABORATORY BIODEGRADATION AND ENVIRONMENTAL STUDIES,
Soap and Detergent Association, New York.
For primary bibliographic entry see Field 5A.
W80-03976

PHOTOSYNTHETIC CARBOXYLATING ENZYMES IN MARINE PHYTOPLANKTON,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
For primary bibliographic entry see Field 5C.
W80-04146

2L. Estuaries

PRELIMINARY OBSERVATIONS ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF ROSS BAY, A POLLUTED AREA OF LOUGH LEANE, SOUTH-WEST IRELAND,
University Coll., Dublin (Ireland). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-03934

STABILITY OF RHODAMINE WT IN SALINE WATERS,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
W. D. Stanbro, and D. A. Pyrch.
Water Resources Research, Vol 15, No 6, p 1631-1632, December 1979. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *Rhodamine, *Fluorescent dye, *Tracers, *Saline water, Salinity, Hydrogen ion concentration, Fluorometry, Laboratory tests, Evaluation, Dyes, Estuaries, Dye stability.

The stability of rhodamine WT dye was investigated in buffered and unbuffered NaCl solutions and in natural waters of varying salinity. Despite previous reports in the literature, no significant decay attributable to salinity effects was seen. The maximum decay observed was 5% after 327 hours. (Sims-ISWS)
W80-04036

A NOTE ON DIFFUSION FROM A CONTINUOUS LINE SOURCE IN A TIME VARYING FLOW,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W80-04037

APPLICATION OF SHORT-TIME SCALE RECORDING METER DATA TO NUMERICAL MODELLING OF TORONTO HARBOUR,
Ontario Ministry of the Environment, Toronto.
For primary bibliographic entry see Field 5B.
W80-04057

WAVE-INDUCED LIQUEFACTION: A MODERN EXAMPLE FROM THE BAY OF FUNDY,
McMaster Univ. Hamilton (Ontario). Dept. of Geology.
R. W. Dalrymple.
Sedimentology, Vol 26, No 6, p 835-844, December 1979. 4 Fig, 42 Ref.

Descriptors: *Sand bars, *Geomorphology, *Tidal waters, *Intertidal areas, Bays, Sediments, Deformation, On-site investigations, Waves(Water), Tidal effects, Beds, Shape, Ripple marks, Nova Scotia, *Cobequid Bay(Nova Scotia), *Bay of Fundy, Liquefaction.

Soft-sediment deformation features occur commonly on parts of intertidal sand bodies in Cobequid Bay, Bay of Fundy. These features are small- to intermediate-sized, slump-like bodies, 1-3 sq m in area, and located on the crest and upper stoss side of ebb megaripples. External modification of these slumps indicates that they formed before complete emergence. The deformed cross-bedding within these bodies extends to a depth of 0.15-0.35 m and shows that deformation occurred during slumping and flowage of liquefied sand down the megaripple stoss side. Field evidence and calculations strongly indicate that this liquefaction results from the impact of 0.1-0.3 m high waves breaking against the megaripple lee faces. Neither rapid drawdown of the water level nor earthquake shocks are reasonable alternative explanatios. Indigenous wave activity provides an attractive substitute to tectonism as an explanation of soft-sediment deformation in ancient shallow-water sediments. Slow wave-induced compaction may also account for the relative scarcity of deformation structures in shallow marine sand-stones. (Humphreys-ISWS)
W80-04061

SHELF-SEDIMENT DYNAMICS AND SOLID-WASTE DISPOSAL,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5C.
W80-04063

THE PROBLEM OF MISPLACED SEDIMENT,
Virginia Inst. of Marine Sciences, Gloucester Point.
For primary bibliographic entry see Field 5C.
W80-04071

SOME PHOTOSYNTHETIC CARBON FIXATION PROPERTIES OF SEAGRASSES,
Tel Aviv Univ. (Israel). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-04129

ORIGINS OF OCEANIC PLANKTON IN THE MIDDLE ATLANTIC BLIGHT,
California Univ., Santa Barbara. Marine Science Inst.
J. Cox, and P. H. Wiebe.
Estuarine and Coastal Marine Science, Vol 9, No 5, p 509-527, November 1979. 6 Fig, 5 Tab, 58 Ref. ONR N00014-74-C0262, NR083-004.

Descriptors: *Eddies, *Zooplankton, *Species composition, *Middle Atlantic Bight, *Atlantic Coastal Plain, *Currents(Water), Gulf Stream, Continental shelf, Continental slope, Speciation, Meanders, Water circulation, Movement, Atlantic Ocean, Northeast U.S., Oceans, Physical properties, Flow, Sargasso Sea, Ocean circulation.

Introduction of expatriated zooplankton species into the mid-Atlantic Bight is largely associated with advective water movements onto the continental shelf. Arctic-Boreal species are brought in from the northeast largely by over-shelf transport. Transition zone species are brought in by slope water penetration, at the surface when horizontal density gradients are minimal and at mid-depth in response to physical processes such as estuarine-type circulation, wind-driven upwelling, cold-shelf water 'bubble' formation and movement out into slope waters, or shelf-slope water interactions associated with warm core eddies or rings. Tropical-subtropical species that commonly reside in the Gulf Stream and Sargasso Sea also occur in the mid-Atlantic Bight due to injections of warm core ring surface waters over the shelf. The Bight area is divided into three regions with regard to oceanic influences: (1) low salinity waters along the coast south of the Hudson River extending to Chesapeake Bay; (2) the continental shelf edge extending outward from Long Island Sound to past Delaware Bay; (3) the southern sector, including the shelf edge south of 37 degrees N and extending landward south of Chesapeake Bay. Cluster analysis of seasonal transect data off New Jersey verifies the faunal distinctness of regions 1 and 2. Region 1 shows little oceanic influence in terms of expatriate species due to 31 ppt salinities. Region 2 is occupied by slope water species and roughly defines the limits of the cold water species. The southern sector is characterized by warm water species. (Danovich-Wisconsin)
W80-04132

PHYSIOLOGICAL ASPECTS OF PRIMARY PRODUCTION IN SEAGRASSES,
Gatty Marine Lab., St. Andrews (England).
E. A. Drew.
Aquatic Botany, Vol 7, No 2, p 139-150, October 1979. 10 Fig, 4 Tab, 12 Ref.

Descriptors: *Marsh plants, *Primary productivity, *Photosynthesis, *Temperature, *Plant physiology, *Estuarine environments, Irradiation, Laboratory tests, Speciation, Respiration, Leaves, Chlorophyll, Light, Light intensity, Thermal stress, Water temperature, Aging(Biological), Photoperiodism, Estuaries, Grassed waterways, Seasonal.

Laboratory experiments on six seagrass species show that all have similar, classic photosynthesis versus irradiance curves which are usually light-saturated at 2-3 mW/sq cm PAR, and have correspondingly low compensation irradiances since their dark-respiration rates are relatively low. Light-saturated photosynthetic rates vary 26.0-8.1 micro C/sq cm h, depending on species. Maximum photosynthetic rate does not correlate with potential depth distribution; an intertidal species, Phyllospadix torreyi, has the highest rate and one from 33 m, Posidonia oceanica, has the lowest. Light-saturated photosynthetic rates increase in direct proportion to temperature increases up to 30-35C.

above which thermal damage causes rapid reduction. Respiration rates are not so dramatically affected by increasing temperatures. Photosynthetic rates closely correlate with chlorophyll content up to 50-60 micro chl/sq cm. P. oceanica shows marked seasonal photosynthetic rate variations high in spring and low in summer. Low summer rates result from reduced chlorophyll content due to general leaf senescence in this species in early summer. Chloroplast movement in Halophila stipulacea is complex and reduces photoinhibition. Species used in experiments include Cymodocea nodosa, H. stipulacea, P. torreyi, P. oceanica, Zostera angustifolia and Z. marina. (Danovich-Wisconsin)
W80-04134

A DIATOM ASSEMBLAGE LIVING BELOW THE SURFACE OF INTERTIDAL SAND FLATS,
Bristol Univ. (England). Dept. of Botany.
F. E. Round.
Marine Biology, Vol 54, No 3, p 219-223, 1979. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Diatoms, *Barnstable Harbor(MA), *Sediments, *Intertidal areas, *Spatial distribution, *Vertical migration, Ecology, Sands, Speciation, Distribution, Tides, Habitats, Tidal effects, Light, Light intensity, Color, Depth, Drying, Systematics, Amphora cymbifera, Diurnal.

A non-migratory endopsammic diatom association was discovered living below the sand surface of intertidal flats at Barnstable Harbor, Massachusetts. Top sand layers (1 mm) are brown due to dense Hantzschia virgata populations; this species migrates to the surface during tidal exposure. H. virgata moves freely in the spaces between and over sand grains. The colorless middle layer (3 mm) is a mixed zone. H. virgata migrates downwards from the surface layer into this layer prior to dusk. The lowermost layer (3 mm thick) lies above the black anaerobic zone. Large motile pennate species, which presumably do not migrate (Navicula cancellata, Nitzschia spathulata), inhabit this area. Small epipsammic species are also abundant; however, Amphora cymbifera, which attaches to sand grains, characterizes this zone. While this A. cymbifera assemblage is strictly part of the epipsammic community, it differes from the more widespread epipsammic flora in its spatial distribution. Visual observation reveals a much greater cell concentration below 3-4 mm depth. Light intensity is less at greater depths; however, desiccation is a limiting factor in surface layers. Movement of surface sand during tidal covering and uncovering also leads to species loss from sand grains. (Danovich-Wisconsin)
W80-04143

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

TECHNICAL AND ECONOMIC EVALUATION OF AN MSF SOLAR ENERGY POWERED DESALINATION PLANT,
S. Arazzini, G. Tomei, E. Ciccone, and G. Fiorito.
Desalination, Vol 31, No 1-3, p 443-455, October 1979. 5 Fig, 1 Tab.

Descriptors: *Solar energy, *Economic feasibility, *Desalination plants, *Technology, *Systems analysis, *Cost analysis, Solar distillation, Water treatment, Desalination processes, Desalination apparatus, Water purification, Economics, Costs, Design, Design criteria, Economic justification, Electric power, Reliability, Evaluation.

The most feasible desalination plant powered by solar energy, considering technical and economic aspects, is one using a single field of double axis tracking collectors. Besides its low cost, it presents the easiest plant arrangement and process parameters control. The type of desalting unit chosen is the multistage flash (MSF) with brine recirculation, since it allows the greatest guarantee of reliability over long time periods. High solar energy costs necessitate the highest performance ratio values that can be obtained; the plant is designed as a 500 cu m/d, 46 stage, cross-tube type with 121C top brine temperature and 38.5 Kcal/kg distillate specific heat consumption. Different systems to trap solar energy are considered, taking into account process parameters such as: outlet fluid temperatures from solar receivers, performances, power production system, power consumptions, energy storage, back-up and energy integration systems, and desalting and solar equipment reliability. Three different solutions are examined: (1) double axis collectors with a main storage tank volume; (2) double and single axis collectors with oil and pressurized water tank volumes; and (3) double and single axis collectors with electrical storage (batteries). A solar powered desalting plant is not only feasible, but also attractive economically at least in some countries. (Danovich-Wisconsin)
W80-04155

3C. Use Of Water Of Impaired Quality

IMPACT OF WASTE DIVERSION ON WATER QUALITY IN LAKES,
Limno Tech, Inc., Ann Arbor, MI.
P. L. Freedman, and R. P. Canale.
Journal of the Environmental Engineering Division, ASCE, Vol 105, No 5, p 867-881, October 1979. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Water quality control, *Waste water disposal, *Diversion, *Lake renewal, *Spray irrigation, Lakes, Trophic level, Nutrients, Michigan, Muskegon Lake(MI), Mona Lake(MI), White Lake(MI), Phosphorus, Chlorophyll, Secchi disks, Waste water treatment, Sampling, Water utilization, Eutrophication.

In 1973, Muskegon County, Michigan began diversion of industrial and municipal wastewater discharges from Muskegon, Mona, and White lakes in an effort to reverse environmental and economic degradation in the region and to meet stringent U.S. Environmental Protection Agency effluent standards. The wastewater was pretreated in aerated lagoons, disinfected, and sprayed on agricultural land. Drainage from the spray irrigation site was collected and discharged to the tributaries of three lakes. The extensive limnological investigation conducted in conjunction with the project focused on eutrophication-related parameters. Tributary and lake sampling began prior to wastewater diversion in 1972 and continued through 1975. Sampling was conducted approximately biweekly during the ice-free season, and monthly during the ice season. Fourteen sampling locations were selected to assess the spatial variation of water quality in each lake and to evaluate the importance of various point sources of contamination. The wastewater treatment has resulted in a significant decrease of phosphorus concentrations in Mona and Muskegon lakes, and in a decrease of chlorophyll-a in Muskegon and White lakes. None of the lakes experienced significant improvements in Secchi disc transparency. The diversion project has altered the overall condition of the lakes in such way that the lakes should be responsive to additional reductions in nutrient loadings. (Harris-Wisconsin)
W80-04144

3D. Conservation In Domestic and Municipal Use

THE COSTS AND BENEFITS OF WATER METERING,
International Bank for Reconstruction and Development, Washington, DC. Energy Water and Telecommunications Dept.
For primary bibliographic entry see Field 6B.
W80-03974

ECONOMICS AND WATER CONSERVATION PART 2,
Department of the Interior, Washington, DC. Office of Minerals Policy and Research Analysis.
R. K. Schaefer.
Water and Sewage Works, Vol 126, No 8, p 28-30, August 1979. 3 Fig, 7 Tab.

Descriptors: *Water conservation, *Water rates, *Economics, *Elasticity of demand, Costs, Water costs, Rates, Economic impact, Social aspects, Water utilization, Consumptive use, Income, Water demand, Utilities, Pricing, Economic efficiency, Public health, Safety, Potable water.

This second half of a two-part article concerning various economic incentives for water conservation, deals specifically with the influence of elasticity and rate structure on use patterns. The foremost principal of conservation is to minimize total water use costs to the community and not necessarily the rate per unit water. Knowledge of demand elasticities for different water uses is important in estimating effects of pricing policies or rate structure relative to conservation objectives. Water demands are generally inelastic (-0.1 to -0.5) but some water uses such as lawn-watering are elastic (-0.5 to -1.2). Efficient and equitable rate structures create awareness of water resource problems. Uniform rates reward water conservation if the total bill is reduced when less water is used. Where average costs are rising, the average or uniform rate is not necessarily equitable; those who conserve water have to pay more per unit because of large water use by others. Decreasing block rates encourage water use. Increasing block rates are the most effective rates to achieve water conservation, flow-reduction objectives. Fairness problems with increasing block rates raise basic questions: (1) the major objective of utilities is to provide safe, potable water; (2) there is a payment burden of prior residents to pay higher costs caused by demands of newer residents. The increasing block rate is efficient in that it places utilities in competition for disposable income at high water-consumption levels but allows them to meet their public service, health and safety functions at minimum cost to consumers. (See also W80-01970) (Danovich-Wisconsin)
W80-04149

3F. Conservation In Agriculture

URBAN LAWN EVAPOTRANSPIRATION--MEASUREMENT AND PREDICTION,
Pool (Charles) and Associates, Inc., Ketchikan, AK.
For primary bibliographic entry see Field 2D.
W80-04021

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

USE OF EXTREME VALUE THEORY IN ESTIMATING FLOOD PEAKS FROM MIXED POPULATIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2E.
W80-04015

MULTIOBJECTIVE DYNAMIC PROGRAMMING WITH APPLICATION TO A RESERVOIR,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
G. W. Tauxe, R. R. Inman, and D. M. Mades.
Water Resources Research, Vol 15, No 6, p 1403-1408, December 1979. 3 Fig, 13 Ref. OWRT B-105-ILL(3).

Descriptors: *Water resources, *Reservoirs, *Dynamic programming, *Model studies, Mathematical models, Computer models, Mathematics, Equations, Management, Water

management(Applied), Reservoir operation, Storage, Powerplants, Hydroelectric power, Evaporation, Analytical techniques.

The analysis of water resource problems often involves noncommensurable objectives. Where this is the case, no clear-cut optimum solution exists, but rather a whole set of technologically efficient 'noninferior' solutions exists. A water resources decision maker, who reflects society's preferences, chooses the single noninferior solution preferred to all the others. Multiobjective dynamic programming was introduced as an extension of dynamic programming which can provide the decision maker with the entire noninferior set of solutions as well as the explicit trade-offs between noncommensurable objectives at all objective levels to aid him in the decision-making process. The technique made possible the quantitative analysis of multiple-objective problems which would provide great difficulties for the existing methods. An example of such a problem was presented and solved by multiobjective dynamic programming. The problem involved the generation of the noninferior set and trade-off curves for the operation of a reservoir considering three objectives. (Sims-ISWS)
W80-04025

MULTIOBJECTIVE DYNAMIC PROGRAMMING: A CLASSIC PROBLEM REDRESSED,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
G. W. Tauxe, R. R. Inman, and D. M. Mades.
Water Resources Research, Vol 15, No 6, p 1398-1402, December 1979. 1 Fig, 16 Ref. OWRT B-105-ILL(2).

Descriptors: *Water resources, *Reservoirs, *Planning, *Model studies, Mathematical models, Dynamic programming, Computer programs, Mathematics, Equations, Management, Reservoir operation, Storage, Irrigation, Water management(Applied), Analytical techniques.

The problem of noncommensurable multiple-objective functions in water resources and potential methods for solving such multiobjective problems were discussed. A new method, namely, multiobjective dynamic programming (MODP), that borrows from conventional dynamic programming, was developed. It generates the entire noninferior solution set of the multiobjective problem, and it can be used to generate the trade-off ratios between objectives. The trade-off ratios are actually a by-product of the MODP method and are available explicitly between all objectives. The noninferior solution set is obtained solely in terms of the objectives rather than in terms of the individual decisions that influence each objective, thus facilitating the decision maker's task in choosing the preferred solution. The Reid-Vemuri multiobjective problem in water resources was chosen as an example and was successfully solved using MODP. (Sims-ISWS)
W80-04026

EFFECTS OF CLEARCUTTING ON SOIL WATER DEPLETION IN AN ENGELMANN SPRUCE STAND,
Utah State Univ., Logan. Watershed Science Unit.
G. E. Hart, and D. A. Lomas.
Water Resources Research, Vol 15, No 6, p 1598-1602, December 1979. 2 Fig, 4 Tab, 16 Ref. UTA 777.

Descriptors: *Clear-cutting, *Soil water, *Water yield, *Utah, Lodgepole pine trees, Soil moisture, On-site tests, Watersheds(Basins), Evapotranspiration, Demonstration watersheds, Water equivalent, Water yield improvement, Watershed management, Engelmann spruce trees, Soil water depletion.

Soil water depletion was monitored for five growing seasons on 0.4-hectare plots in a mature stand of Engelmann spruce in northern Utah. Three plots were then clear-cut, and in the first season soil water depletion was 20 to 25 cm less than on an uncut plot. This change, which represents a savings of water previously lost to evapotranspiration, is considerably greater than reported for comparable studies in aspen and lodgepole pine. The effects of clear-cutting on soil water depletion are expected to persist for as many as 50 years. In the first winter after cutting, peak snow water equivalent in the clear-cut plots averaged 91 cm, or 31 cm greater than for the uncut control plots. (Humphreys-ISWS)
W80-04034

POST-WAR LAND DRAINAGE, FERTILIZER USE AND ENVIRONMENTAL IMPACT IN NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
D. N. Wilcock.
Journal of Environmental Management, Vol 8, No 2, p 137-149, 1979. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Drainage programs, *Fertilization, *Environmental effects, *Northern Ireland, Drainage districts, Streamflow, Water quality, Fish management, Legislation, Drainage area, Watersheds(Basins), Tributaries, Sediment transport, Rivers.

Coordinated efforts to implement land drainage schemes in Ireland date to 1842, when 113 drainage districts were established throughout the country. However, most of the drainage schemes predating 1940 were piecemeal and ineffective. In 1947, the Drainage Act introduced a comprehensive strategy of land drainage into which local field drainage schemes were later integrated. In order to implement the Act, a Drainage Council was established. Between 1947 and 1977, the Council has designated 212 rivers (1,878 km) as the main arteries. Projects on these rivers varied in size and type of work performed. Some projects involved removal of local obstructions to flow, major channel realignments and substantial widening of the rivers. Since 1948, the total benefit area was 38,366 ha. In addition, efforts were made to improve outflow conditions in the tributaries of the main rivers. Between 1947 and 1976, 3,250 km of tributary channels have been improved. Under the auspices of the same program, financial assistance was made available for urban and rural drainage projects and fertilizer use. The improvements affected streamflow, water quality and fish production. However, research on the relationship between the drainage schemes and the resultant environmental impacts in Ireland has just begun. It is not known how drainage projects affected streamflow. Also, more research is needed to evaluate the effect of increased fertilizer use and sediment transportation on water quality and fish production. (Harris-Wisconsin)
W80-04115

UPTAKE AND RELEASE OF NUTRIENTS BY AQUATIC MACROPHYTES,
Mankato State Univ., MN. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-04136

THE 1976-1977 CALIFORNIA DROUGHT--A REVIEW,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 2E.
W80-04189

4B. Groundwater Management

EFFECT OF INFILTRATION RATE ON BIOLOGICAL CLOGGING AND WATER QUALITY CHANGES DURING ARTIFICIAL RECHARGE,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
T. Okubo, and J. Matsumoto.
Water Resources Research, Vol 15, No 6, p 1536-1542, December 1979. 12 Fig, 4 Tab, 8 Ref.

Descriptors: *Artificial recharge, *Clogging, *Infiltration rates, Laboratory tests, Mathematical models, Infiltration, Water reuse, Biology, Dissolved oxygen, Ammonia, Chemical oxygen demand, Recharge, Waste water disposal, Hydraulic conductivity, Groundwater movement, Groundwater, Biological clogging.

The effect of infiltration rate on biological clogging and water quality changes was investigated experimentally using a sand column. The concentration of soluble COD in the effluent was stable during 3 months of infiltration, and the lower the initial infiltration rate was, the higher the average percentage of the reduction of soluble COD became. The soluble COD was primarily removed in the surface layer. The hydraulic conductivity in the bottom layer decreased at the highest infiltration rate. The variation of infiltration rate was divided into four stages. In addition, the biological-clogging model was proposed, and the mechanism of biological clogging was discussed. (Sims-ISWS)
W80-03950

THE BALANCE OF GROUNDWATER RESOURCES OF THE EUROPEAN COMMUNITY: A METHODOLOGY FOR A MULTINATIONAL PROBLEM,
Strasbourg-1 Univ. (France).
J. J. Fried, and M. Zampetti.
Water Supply and Management, Vol 3, No 3, p 201-204, 1979.

Descriptors: *Groundwater, *Groundwater resources, *European community, *Water supply, *Groundwater management, *Model studies, *Environmental protection, Resources, Water resources, Groundwater availability, Groundwater utilization, Groundwater potential, Protection, Groundwater recharge, Exploration.

A major part of the freshwater resources available in the European Community is made up of groundwater. The Commission of European Communities is thus emphasizing actions of protection and management of water resources and particularly of groundwater resources. It has undertaken a series of studies on the availability of water resources, management methods, medium and long-term supply problems, integrated management, and classification of community territory on the basis of environmental characteristics. Based on these studies a new study is underway which should produce a quantitative assessment of groundwater resources. The aim is to estimate the available resources in present conditions of recharge and exploitation as well as potential development areas and complementary resources. Only existing data will be used. The hydrogeological results will be made available in 1979. The study is led by consultants and a coordinator who will present the final synthetical analysis. In addition, to cope with any difficulties and to harmonize the scientific approaches there is a panel to debate fundamental questions and common technical problems. In addition to the synthetical report, national reports and four community maps (aquifer inventory, hydrogeological situations, exploration, available resources) will be published. (Iervolino-NC)
W80-04182

4D. Watershed Protection

SOURCES OF SEDIMENT INDUCED REDUCTIONS IN WATER QUALITY APPRAISED FROM CATCHMENT ATTRIBUTES AND LAND USE,
H. W. Anderson.
In: Proceedings of Third World Congress on Water Resources, Mexico City, Mexico, April, 1979. Vol 8. p 3603-3613, 1979. International Water Resources Association, Mexico City.

Descriptors: *Sedimentation, *Water quality, Erosion, *Suspended sediment, Geology, Faults, Landslides, Topography, Slope, Channels, Forest fires, Logging, Lumbering, Watershed management, Streamflow, Snow, Geomorphology, Elevation, Grasslands, *Sediment transport, *Land use, Watesheds(Basins), Regression analysis, Principal components, Rain-snow frequency, Catchments, Channel slope, Grazing, Vegetation, Sediment sources, Turbidity.

Suspended sediment measurements from 61 northern California watersheds were utilized in relating normalized suspended discharge to 10 watershed attributes. Suspended sediment was normalized by using long-term streamflow of each watershed. Factor analysis showed no confounding among the 10 variables; regression on principal components gave an explained variance of 0.73. Landslide potential contributed 42 percent of the explained variance; land-use variables 30 percent; streamflow and rain-snow frequency, 14 percent; geology including faults, 11 percent; and channel slope the other 3 percent. The regression coefficients indicated that watershed shape was the least important variable, with palm-shaped watershed having only 13 percent more sediment discharge than dendritic-shaped watersheds. Different landslide classes produced the greatest differences in sediment discharge: sediment discharge from landslide class 6 was 12 times as great as that from class 1. Use of the results were illustrated in separating normal from accelerated sediment production in the Redwood Creek basin. A separate analysis related landslide class to 6 watershed attributes and broad geologic rock types.
W80-03967

MULTIOBJECTIVE OPTIMIZATION IN WATER QUALITY AND LAND MANAGEMENT,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W80-04027

WATER QUALITY AND MINING: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W80-04180

5. WATER QUALITY MANAGEMENT AND PROTECTION

DEPOSITIONAL CHARACTERISTICS OF SEDIMENTS AT A LOW ENERGY OCEAN DISPOSAL SITE, SAVANNAH, GEORGIA,
Skidaway Inst. of Oceanography, Savannah, GA.
G F. Oertel.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 97-107, 1979. 3 Fig, 10 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Water pollution effects, *Sediments, Sedimentation, Environmental effects, Georgia, *Outer Continental Shelf, *Dredged material, Ocean dumping, Savannah Harbor.

Since the early 1900's, the bar-channel system of the Savannah navigation channel has been dredged for maintenance and improvement. Between 1967 and 1977, approximately 10.8 x 1,000,000 cu yds (8.3 x 1,000,000 cu meters) of this dredge material was deposited at a predetermined ocean disposal site. The prominent sources of material dredged from the navigation channel are fine-grained river deposits, littoral sands, Pleistocene river gravels, and submarine Miocene outcrops. Material that is released from hopper dredges is hydraulically sorted as it settles through the water column. Coarse material is deposited in relatively thick mounds corresponding to the disposal path of the dredge; thin layers of fine material accumulate in deeper areas adjacent to mounds. After deposition, the fine and coarser material is relatively stable during non-storm conditions. During storm conditions, coarse material in the upper parts of the mounds are reworked by waves and storm currents. (Sinha-OEIS)
W80-04067

5A. Identification Of Pollutants

CHEMISTRY OF WATER MILFOIL TISSUE: SEASONAL VARIATION IN SUBMERSED APICES,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
K. D. Kimball, and A. L. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159726, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of New Hampshire Research Report 25, 1980. 47 p, 46 Fig, 3 Tab, 35 Ref. OWRT A-043-NH(3), A-052-NH(1).

Descriptors: *Minerals, *Chemical properties, *Plant tissues, *Submerged plants, Phosphorus, Sodium, Potassium, Calcium, Magnesium, Iron, Manganese, Zinc, Copper, *Water pollution effects, *Seasonal variations, *Myriophyllum heterophyllum, *Mineral levels, *Water milfoil, Lake Winnipesaukee(NH), Nutrient availability.

The mineral composition of submersed apices in Myriophyllum heterophyllum from Lake Winnipesaukee were analyzed from 1976 through 1978. Seasonal changes in ash, phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, zinc and copper were quantified. The magnitude of the seasonal and spatial variations in mineral tissue levels is large. Ash, phosphorus, sodium, potassium, calcium and magnesium vary by a factor (max/min) of 3-5 during an annual cycle. Variations for iron, manganese and zinc are much greater, with max/min ratios of 13-64. Our results question the practicality and validity of reported techniques which use mineral concentrations as an index of nutrient availability and as monitors of aquatic pollutants. We also conclude that inter- and intraspecific comparisons in the chemical composition of aquatic plants should include seasonal analysis on the different plant tissues, if nutrient dynamics and interrelationships of rooted aquatic plants with water and sediment chemistry are to be understood.
W80-03910

HUMAN VIRUSES IN THE AQUATIC ENVIRONMENT: A STATUS REPORT WITH EMPHASIS ON THE EPA RESEARCH PROGRAM.
Environmental Research Center, Cincinnati, OH.
Report to Congress No EPA-570-9-78/006, December 1978. 44 p, 1 Fig, 2 Tab, 88 Ref, 2 Append.

Descriptors: *Viruses, *Disease, *Public health, *Potable water, *Human diseases, Epidemiology, Water pollution sources, Sewage treatment, Environmental sanitation, Water sampling, Sanitary engineering, Water purification, Disinfection, Indicators, Analytical techniques.

Knowledge on the transmission of waterborne enteric human viruses is reviewed. Approximately 100 such viruses are excreted in large numbers in the feces of infected individuals. While the viruses do not multiply in aquatic environments they may survive for long periods of time and may be present in drinking waters. While outbreaks of viral diseases caused by drinking sewage-contaminated water are well documented, the role of 'acceptable' drinking water in this transmission is not clear. The Environmental Protection Agency (EPA) has been active in the development of methods for the recovery of low numbers of viruses from large water samples. Viral detection methods have improved in the past 15 years but are still not adequate to assess the possibility of extremely low levels of viruses existing in 'acceptable' drinking water. Also due to the common person-to-person spreading of these diseases it is difficult to access the role of drinking water in the transmission. EPA has collected and tested 250 drinking water samples from 56 systems in the past 6 years with no viral isolations having been made. Other laboratories have made some confirmed isolations from treated drinking water samples but better detection techniques are needed. Despite much research and study the possibility of 'focal infections', those caused by ingestion of water containing very low levels of virus, has been neither proved nor disproved. It currently appears that full conventional water treatment is needed to provide a reasonable assurance of virologically safe drinking water. Recommendations are made for the improvement of recovery methods and for the development of more effective sewage treatment. (Seigler-IPA)
W80-03922

CHARACTERIZATION OF THE WATER QUALITY IN THE SAINT LAWRENCE RIVER: DETERMINATION OF HOMOGENEOUS ZONES BY CORRESPONDENCE ANALYSIS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
M. Lachance, B. Bobee, and D. Gouin.
Water Resources Research, Vol 15, No 6, p 1451-1462, December 1979. 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Water quality, *St. Lawrence River, *Correlation analysis, Nitrogen, Phosphorus, Turbidity, Nutrients, Sampling, Data processing, Analytical techniques, Rivers, Pollutants, Water pollution, Spatial distribution.

The application of correspondence analysis to data for turbidity, inorganic nitrogen, and inorganic phosphorus gathered at 112 stations located in the Cornwall-Quebec reach of the Saint Lawrence River allows the behavior of these three parameters to be detailed. A cluster analysis applied to the results of correspondence analysis leads to the definition of homogeneous zones which are characterized by values of the three parameters considered. The results obtained enter into the design processes of quality network for the Saint Lawrence River by allowing for the elimination of a certain number of stations. (Sims-ISWS)
W80-03955

ANALYSIS OF NEVADA SURFACE WATERS FOR PATHOGENIC AMOEBAE AS INDICATORS OF THERMAL POLLUTION,
Nevada Univ., Reno. Desert Research Inst.
J. Thomford, and R. Mead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158041, Price codes: A02 in paper copy, A01 in microfiche. Publication 50015, February 1980, 23 p, 9 Tab, 24 Ref. OWRT A-092-NEV(1), 14-34-0001-9030.

Descriptors: *Water quality, *Pathogenic amoebae, *Thermal pollution, Water analysis, Indicators, Bioindicators, Nevada, Truckee River(Nev), Carson River(Nev).

Two major rivers in northwestern Nevada, the Truckee and Carson, were examined for the occurrence of the potentially pathogenic, free-living amoebae, Naegleria fowleri, Acanthamoeba culbertsoni and A. rhysodes, for a period of one year. Water quality was also monitored. A. rhysodes and a strain believed to be intermediate to N. gruberi and N. fowleri were isolated and identified. Presence of the recovered N. fowleri strain and A. rhysodes was compared to water temperature in an attempt to determine whether the presence of either of these species might be utilized as an indication of thermal pollution.
W80-03960

ICHTHYOPLANKTON OF THE ST. LAWRENCE ESTUARY: COMPOSITION, DISTRIBUTION, AND ABUNDANCE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W80-03965

ANALYTICAL METHOD FOR NONIONIC SURFACTANTS IN LABORATORY BIODEGRADATION AND ENVIRONMENTAL STUDIES,
Soap and Detergent Association, New York.
S. L. Boyer, K. F. Guin, R. M. Kelley, M. L. Mausner, and H. F. Robinson.
Environmental Science & Technology, Vol 11, No 13, p 1167-1171, December 1977. 2 Fig, 5 Tab, 12 Ref.

Descriptors: *Water chemistry, *Analytical techniques, *Biodegradation, *Surfactants, *Foaming, Detergents, Water quality, Laboratory tests, Ion exchange, Colorimetry, Methodology, Foam fractionation, Foam separation, Chemicals, Chemical degradation, Measurement, Evaluation, Testing procedures, Water analysis, Quality control.

For biodegradation studies, the measurement of cobalt thiocyanate active substances (CTAS) is recommended along with sublation; for environmental studies, an improved sublation procedure, ion exchange and CTAS measurement are recommended. Of the colometric techniques, cobalt thiocyanate measurements are successfully applied to biodegradation and environmental studies. Nonionic surfactants are determined by complexation with cobalt thiocyanate and subsequent colorimetry. Simplicity and fast operation make it an attractive alternative to bismuth potentiometric measurements. The 1972 Wickbold methods (DAS) for trace nonionic surfactant levels involves nonionic isolation by foaming. The Wickbold sublation procedure is an effective and relatively simple concentration step for surface active agents; however, in environmental samples, ion-exchange separation must take place after sublation. CTAS and Wickbold's procedure, or bismuth potentiometric measurements, yield comparable analytical data, allowing mutual acceptance of data collected by either method and providing a proven alternative method. CTAS and DAS comparability for environmental monitoring was established consensually among six laboratories. Light and heavy solids from sewage influent were investigated. Interlaboratory relative standard deviations were 11% for the light solids solution and 16% for the heavy solids solution. Nonionic recovery was 90% with four sublations. (Danovich-Wisconsin)
W80-03976

FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS--V THE TOXICITY OF THE GELLING COMPOUNDS FOR PETROLEUM TO MARINE ORGANISMS (IN JAPANESE),
Tokyo Univ. (Japan). Dept. of Fisheries.
H. Tokuda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1385-1387, 1979. 3 Tab, 7 Ref, (English Summary).

Descriptors: *Toxicity, *Organic compounds, *Oil pollution, Diatoms, Marine fish, Mortality, Lethal limit, Bioassay, Oil, Growth rates, *Gelling compounds.

The toxicity of two products (abbrev. A and B) of the gelling compounds used to solidify petroleum was assayed for a marine diatom, Skeletonema costatum, and a rice fish, Oryzias Patipes, which had been previously acclimated to sea water. The following results were obtained: the lethal amounts of A and B to the diatom are more than 1,000 mg/l and 560 mg/l respectively, when A and B are separately added to the culture medium; the 24-h LA50 (which means the lethal amount of the gelling compound to 50% of the test organisms in 24 hours) of A and B to the fish are 7,400 mg/l and 4,700 mg/l respectively, when A and B are separately added to the test sea water; the filtrate of the culture medium or the sea water containing A or B is far less toxic to these test organisms. (Deal-EIS)
W80-03981

HEAVY METAL TOLERANCE OF MARINE PHYTOPLANKTON. IV. COMBINED EFFECT OF ZINC AND CADMIUM ON GROWTH AND UPTAKE IN SOME MARINE DIATOMS,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
G. S. Braek, D. Malnes, and A. Jensen.
Journal of Experimental Marine Biology and Ecology, Vol 42, p 39-54, 1980. 11 Fig, 5 Tab, 17 Ref.

Descriptors: *Zinc, *Cadmium, *Diatoms, *Absorption, Toxicity, Heavy metals, Growth rates, Sorption, Phytoplankton, Path of pollutants, Metabolism, Magnesium.

Combinations of zinc and cadmium ions acted synergistically on the growth of the marine diatoms Thalassiosira pseudonana and Skeletonema costatum. Mixtures of the metals behaved less than additively on Phaeodactylum tricornutum and antagonistically on Skeletonema costatum. Sorption studies supported the hypothesis that the two latter algae gained their relative resistance to heavy metal ions from competition for uptake sites by the zinc and cadmium species involved. In the more resistant alga, Phacodactylum tricornutum, the sorption of cadmium and zinc was also dependent on the magnesium concentration of the medium, in a way which indicated a common uptake route for several divalent cations in this species. Cadmium was found to be more toxic than zinc to Skeletonema costatum and to Thalassiosira pseudonana, while zinc was slightly more toxic than cadmium to Phacodactylum tricornutum and Skeletonema costatum. (Deal-EIS)
W80-03982

THE BACTERIAL FLORA OF CERTAIN MARINE FISHES AND PRAWNS IN COCHIN WATERS IN RELATION TO THEIR ENVIRONS,
Central Inst. of Fisheries Technology, Cochin (India).
For primary bibliographic entry see Field 5C.
W80-03984

HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: HAEMOGLOBIN ELECTROPHORESIS, ATP LEVELS AND CORPUSCULAR FRAGILITY CURVES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
G. L. Smit, J. Hattingh, and A. P. Burger.
Journal of Fish Biology, Vol 15, p 655-663, 1979. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Toxicity, *Fish physiology, *Organic compounds, Aquiculture, Carp, Rainbow trout, Mode of action, Electrophonesis, Chemical analysis, Freshwater Fish, Fish management, Chemical properties, *MS222, *Fish anaesthetics, *Anaesthetics, *Blood chemistry, *Tissue analysis, *Sarotherodon.

The effects of MS222 and neutralized MS222 anaesthesia on haemoglobin electrophoresis, erythrocyte adenosine triphosphate (ATP) levels and corpuscular fragility curves were studied in Cyprinus carpio, Sarotherodon mossambicus and Salmo gairdneri. Haemoglobin electrophoresis showed no significant intra-species differences in the percentage composition of the various fractions for any concentration of MS222 and neutralized MS222 used. Significant interspecies differences were, however, still observed. ATP levels showed intra- and interspecies differences ascribed to the response of the fish species to MS222-induced stress and not to actual changes in erythrocyte ATP concentrations. Differences were also observed in corpuscular fragility curves for all three species when using MS222 or neutralized MS222 compared to curves obtained without the use of the anaesthetic, but the mechanisms involved are not clear. (Deal-EIS)
W80-03988

THE EFFECT OF DISSOLVED COPPER ON THE INCREASE IN LENGTH OF FOUR SPECIES OF INTERTIDAL FUCOID ALGAE,
Trondheim Univ. (Norway). Museum.
T. Stromgren.
Marine Environmental Research, Vol 3, p 5-13, 1980. 7 Fig, 14 Ref.

Descriptors: *Copper, *Toxicity, *Growth rates, *Phaeophyta, Algae, Inhibition, Heavy metals, Statistical analysis, Resistance, Length, Bioassay, Water chemistry, Aquatic plants, *Fucus, Pelvetia.

The growth of Pelvetia canaliculata, Fucus spiralis, Fucus vesiculosus and Fucus serratus is measured in various concentrations of copper (12-970 microg/litre) during a period of ten days. Significant reductions in growth were observed at 12 microg/litre of copper added for P. canaliculata and F. spiralis, at 25 microg/litre for F. serratus and at 50 microg/litre for F. vesiculosus. There is a linear relationship between the percentage reduction (z) in growth rate and the product of time (x) and concentration (y), giving the equation $z = k X x X y$. The constant k is specific and may be used as a measure of resistance capacity to copper exposure. When previous data on Ascophyllum nodosum are included the five large Fucoids in the intertidal area may be ranked as follows according to their resistance capacity: A. nodosum > F. vesiculosus > P. canaliculata APPROX. F. spiralis > F. serratus. (Deal-EIS)
W80-03992

MECHANISMS OF REGULATION OF THE ACID-BASE BALANCE IN FISH AS THEY ADAPT TO CARBON DIOXIDE LEVELS IN AN AQUEOUS ENVIRONMENT,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. D. Romanenko, V. A. Krisal'nyy, and N. I. Kotsar.
Hydrobiological Journal, Vol 14, No 5, p 41-47, 1978. 3 Fig, 19 Ref.

Descriptors: *Acid-base equilibrium, *Fish physiology, *Carp, *Carbon dioxide, Water chemistry, Electrolytes, Ions, Potassium, Sodium, Chlorine, Bicarbonates, Hydrogen ion concentration, Animal metabolism, Biochemistry, *Buffers, *Tissue analysis.

In a series of experiments on carp subjected to high C02 levels, changes were determined in inorganic ion exchange (HC03-, C1-, K+, Na+, Ca2(+) and Mg2(+)) as the acid-base balance shifted in the presence of excess C02. A study was made of the dynamics of these ions, their distribution in tissues, and their elimination. It was established that while the concentration of a given ion (HC03-, C1-) changes, there is a decline in the concentration of bases as a result of their removal from tissues and bone, and perhaps an increase in the reabsorption of some elements by the kidneys. (Deal-EIS)
W80-03994

CHANGES IN THE PHYSIOLOGICAL PROCESSES OF AQUATIC ORGANISMS UNDER THE INFLUENCE OF A CONSTANT MAGNETIC FIELD,
Institute of Biology of Southern Seas, Sevastopol (USSR).
A. I. Taneyeva.
Hydrobiological Journal, Vol 14, No 5, p 48-54, 1978. 1 Fig, 5 Tab, 24 Ref.

Descriptors: *Growth rates, *Brine shrimp, *Magnetic studies, Animal physiology, Larval growth stage, Crustaceans, Oxygen requirements, Copepods, Animal metabolism, Respiration, Length, Weight, *Magnetic fields.

A uniform magnetic field speeds the hatching and growth of larvae of A. salina, but depresses oxygen absorption in growing crustaceans. There is less dry weight per unit of length in larvae emerging in a magnetic field that in those growing outside a magnetic field. At different intensities of the magnetic field, the 'magnetic sensitivity' of the animals is stronger in a uniform field than in a non-uniform one. An increase in the water content in the bodies of the crustacea changes their 'magnetic sensitivity'. (Deal-EIS)
W80-03995

CHANGES IN BIOCHEMISTRY OF SOME AQUATIC ORGANISMS OF THE BARENTS SEA COAST IN EXPERIMENTAL OIL INTOXICATION,
Institute of the Biology of Southern Seas, Sevastopol (USSR).
I. A. Divavin, and V. Y. Yerokhin.
Hydrobiological Journal, Vol 14, No 5, p 63-66, 1978. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Biochemistry, *Phaeophyta, *Invertebrates, Oil spills, Water pollution effects, Oil, Toxicity, Mode of action, Proteins, Mussels,

Chemical analysis, Metabolism, *Tissue analysis, *DNA, *RNA, *Nucleotides.

The content of protein, free nucleotides, RNA and DNA is determined in tissues of three species of brown algae and in four species of invertebrates. A comparison of control values with those obtained during oil intoxication showed that the oil induces uncoordinated changes in the biochemical compounds. (Deal-EIS)
W80-03996

KINETICS OF ACCUMULATION OF SOME RADIONUCLIDES BY MARINE BACTERIA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
G. G. Polikarpov, A. Y. Zesenko, and A. V. Parkhomenko.
Hydrobiological Journal, Vol 14, No 5, p 67-72, 1978. 5 Fig, 13 Ref.

Descriptors: *Radioisotopes, *Sorption, *Aquatic bacteria, Cesium radioisotopes, Strontium radioisotopes, Potassium radioisotopes, Zinc radioisotopes, Bacteria, Filters, Chemical properties, Radiochemical analysis, Tracers, *Bioaccumulation, *Calcium radioisotopes.

Sorption of 137Cs, 90Sr, 32P and 45Ca on membrane filters and kinetics of their accumulation in Bacterium halophilum and B. album were studied. Sorption of the first three elements proved to depend on the dry mass of the filters. No such a dependence was observed for 45Ca. The radionuclides accumulated in B. halophilum at concentration factors (per unit dry mass of bacteria) of the order of tens (137Cs), hundreds (65Zn) and tens of thousands (32P) units. Kinetics of 137Cs, 90Sr, 45Ca, 65Zn and 32P accumulation by B. halophilum culture were traced in the course of its development in a closed volume, as were the kinetics of accumulation and excretion of 137Cs by cells of a resting B. album culture. Equilibrium accumulation of 137Cs by cells of a resting culture of B. album is achieved in 90 minutes after the start of the experiment, and half of this nuclide is excreted in 40 minutes. (Deal-EIS)
W80-03997

BASELINE STUDY OF THE LEVEL OF CONCENTRATION OF MERCURY IN THE FOOD FISHES OF BAY OF BENGAL, ARABIAN SEA AND INDIAN OCEAN,
Marine Products Export Development Authority, Cochin (India). Inspection Lab.
V. D. Ramamurthy.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1405-1407, 1979. 2 Fig, 2 Tab, 6 Ref.

Descriptors: *Mercury, *Baseline studies, *Indian Ocean, Heavy metals, Marine fish, Mollusks, Crustaceans, Sampling, Water quality, Standards, Mediterranean Sea, Atlantic Ocean, Pacific Ocean, Path of pollutants, Fish physiology, *Bay of Bengal, Arabian Sea.

Mercury levels in 18 groups of fishes including Mollusca and Crustacea were analysed. The mercury content in all the 18 groups was very low. Differential variation among different groups was also noticed where the mean average value ranges from 5 microg/kg to 65 microg/kg. The levels of concentration of mercury in some of the known food fishes of the Indian Ocean, Bay of Bengal and Arabian Sea have been compared with similar species found in the Mediterranean, Atlantic and Pacific Oceans. It was observed that the mercury content in Mediterranean and Atlantic Ocean species is 2-4 times that of the Indian Ocean species. The present values were also compared with permissible levels of mercury content of different countries. (Deal-EIS)
W80-03999

ROLES OF FOOD AND SEA WATER IN THE ACCUMULATION OF RADIONUCLIDES BY MARINE FISH,
National Inst. of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
Y. Suzuki, M. Nakahara, R. Nakamura, and T. Ueda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1409-1416, 1979. 3 Fig, 8 Tab, 16 Ref.

Descriptors: *Radioisotopes, *Absorption, *Marine fish, Cesium radioisotopes, Zinc radioisotopes, Cobalt radioisotopes, Strontium radioisotopes, Radiochemical analysis, Tracers, Path of pollutants, Fish physiology, Animal metabolism, Water chemistry, Fish food organisms, *Bioaccumulation, *Tissue analysis, *Yellowtail, *Seriola, *Manganese radioisotopes, *Praseodymium radioisotopes, *Rhodium radioisotopes, *Ruthenium radioisotopes.

In the present work yellowtail were labelled by multiple radioisotopes (144Ce-144Pr, 106Ru-106Rh, 85Sr, 137Cs, 54Mn, 65An and 60Co) through water and food, and the radioactivity of each tracer in the tissues or organs of the fish was determined by simultaneous measurement with a Ge (Li) spectrometer. Somewhat different distribution patterns of radionuclides were found in the whole bodies of the fish at the maximum accumulation with the difference in pathways. The results showed that (1) food rather than water supplied most of the 65Zn and 54Mn accumulated by fish, (2) 85Sr and 106Ru-106Rh were mainly accumulated via water and (3) the two pathways played almost the same role in the accumulation of 137Cs, 60Co and 144Ce-144Pr. Therefore, it is necessary to take into account these results for estimation of the extent of radioactive contamination in fish under natural marine ecosystem. (Deal-EIS)
W80-04000

ACCUMULATION AND EXCRETION OF COBALT-60 TAKEN UP FROM SEAWATER BY MARINE FISHES,
National Institute of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
M. Nakahara, S. Hirano, T. Ishii, and T. Koyanagi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1423-1428, 1979. 2 Fig, 4 Tab, 12 Ref.

Descriptors: *Cobalt radioisotopes, *Absorption, *Marine fish, Animal metabolism, Fish physiology, Radiochemical analysis, Path of pollutants, Tracers, Sea water, Nuclear powerplants, *Bioaccumulation, *Tissue analysis.

The accumulation and excretion of 60Co taken up from seawater were observed using marine fishes to examine the radioactive pollution of marine organisms. Blood was a good reserving pool of the nuclide in the fishes. It accumulated more than 15% of the radioactivity in the whole body of the fishes reared for about 90 days in the uptake experiment. Only liver and kidney showed higher radioactivity per unit weight than blood, in the tissues and organs, and muscle showed the lowest concentration of the nuclide. The biological half-lives in muscle of sea bream, yellowtail and flounder at 15C were calculated as 38.5, 53.3 and 63.0 days, respectively. The steady state concentration factors of muscle by direct uptake of 60Co from seawater were estimated in the range from 0.3 to 1.5 among the fishes in the experiments. (Deal-EIS)
W80-04001

DEGRADATION OF THE CRUDE OIL BY ARTHROBACTER SP. (IN JAPANESE),
Kobe Univ. of Mercantile Marine (Japan). Research Inst. of Marine Cargo Transportation.
M. Hirayama, and S. Nagata.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1443-1447, 1979. 7 Fig, 15 Ref, (English Summary).

Descriptors: *Microbial degradation, *Oil, Biodegradation, Metabolism, Bacteria, Aquatic bacteria, Aromatic compounds, Chemical reactions, Chemical properties, Biochemistry, Gas chromatography, *Arthrobacter, *Crude oil.

The degradation experiment of Kuwait crude oil was carried out by using an Arthrobacter sp. strain isolated from the marine environment. From the total weight changes of oil the largest degradation period was found out to be during the first three days. From 6 to 9 days' incubation, the amount of aliphatic hydrocarbon components in crude oil decreased satisfactorily, but for polycyclic aromatic polar compounds the reverse trend was observed, i.e., increment. Such an experimental result might be considered to be the extracellular production of polar compounds produced from the metabolism of aliphatic hydrocarbon substrates. For the aromatic hydrocarbons, the ring cleavage was suggested for monocyclic ones. The bicyclic ones didn't appear to proceed such a reaction path, i.e., only occurrence of degradation for the branched alkyl chains attached to the aromatic ring. The biodegradation percentage of n-alkanes was estimated to be about 87% from the GLC analysis, but only 45% degradation was totally observed through the analysis of weight changes. These results indicate that the aliphatic hydrocarbons other than n-alkanes might be resistant to degradation by this strain. (Deal-EIS)
W80-04002

LONG-TERM EFFECTS OF WATER-SOLUBLE FRACTIONS OF KUWAIT CRUDE OIL ON THE LARVAL AND JUVENILE DEVELOPMENT OF THE MUD CRAB EURYPANOPEUS DEPRESSUS,
Delaware Univ., Lewes. Marine Studies Complex.
T. L. Cucci, and C. E. Epifanio.
Marine Biology, Vol 55, p 215-220, 1979. 5 Tab, 20 Ref.

Descriptors: *Toxicity, *Oil, *Crabs, *Growth stages, Larval growth stage, Growth rates, Crustaceans, Bioassay, Mortality, Mode of Action, Animal physiology, Animal metabolism, *Crude oil, Kuwait crude.

Larvae of the mud crab were reared in various concentrations of the water-soluble fraction of Kuwait crude oil. The 48-h TLm (median tolerance limit) for Zoea Stage I was approximately 10 ppm total dissolved hydrocarbons and that for Zoea Stage II approximately 17 ppm. Chronic toxicity of more dilute solutions (4.3 and 8.7 ppm) was assessed independently for each larval stage and for subsequent developmental stages through Crab Stage 5. In the group continuously exposed to oil from hatching, there was differential mortality relative to controls in every larval stage and increased duration of intermolt periods was observed at every stage through Crab Stage 5. Mortality in groups not exposed until larvae had reached Zoea Stages III or IV was not greater than controls, suggesting that toxicity to advanced larval stages may be related to accumulation of toxic compounds by the larvae. Neither concentration (4.3 or 8.7 ppm) of crude oil caused increased mortality among juvenile crab stages regardless of the time of initial exposure. Increased occurrence of an extra and morphologically abnormal megalopa stage was associated with exposure to the crude oil. This has not been reported before. (Deal-EIS)
W80-04004

MERCURY CONTENTS OF ZOOPLANKTON COLLECTED IN THE TROPICAL PACIFIC OCEAN,
Kumamato Univ., (Japan). Aitsu Marine Biological Station.
R. Hirota, M. Fujiki, and S. Tajima.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 11, p 1449-1451, 1979. 1 Fig, 1 Tab, 9 Ref.

Descriptors: *Mercury, *Zooplankton, *Pacific Ocean, Baseline studies, Heavy metals, Water quality standards, Monitoring, Sampling, Spectrophotometry, Chemical analysis, Japan, *Tissue analysis, *Bioaccumulation, *Methylmercury.

The mercury contents of zooplankton collected at eight stations in the Tropical Pacific Ocean were measured to obtain data as a standard for an unpolluted sea. Mercury values ranged from 0.0188 to 0.1248 ppm with a mean of 0.0575 ppm. The mercury contents measured in this survey were lower

than those of zooplankton collected in the inland sea regions of Japanese, American and European estuaries, and in the oceanic area between Hawaii and California, USA. Such results seem to suggest that the Tropical Pacific Ocean is relatively uncontaminated with mercury. (Deal-EIS)
W80-04007

SURVIVAL OF JUVENILE SPOT (LEIOSTOMUS XANTHURUS) EXPOSED TO BROMOCHLORINATED AND CHLORINATED SEWAGE IN ESTUARINE WATERS,
Virginia Inst. of Marine Sciences, Gloucester Point.
M. H. Roberts, Jr.
Marine Environmental Research, Vol 3, p 63-80, 1980. 4 Fig, 3 Tab, 30 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Marine fish, Sewage treatment, Chlorination, Halogens, Bromine, Bioassay, Disinfection, Fish physiology, Juvenile growth stage, Virginia, James River(Virginia), *Spot, *Leiostomus, Newport News.

The acute toxicity of chlorinated and bromochlorinated treated sewage waste was determined with spot, Leiostomus xanthurus. The halogenated sewage waste was generated in a pilot plant located at the James River Sewage Treatment Plant, Newport News, Va. The 96h and 144h LC50's were 0.23 mg/l (measured residual) for chlorine and 0.25 mg/l (measured residual) for bromine chloride. These concentrations are considerably higher than those which would be produced by optimal halogenation rates for disinfection or maximum superhalogenation rates permitted by pilot plant equipment and normal effluent dilution rates. (Deal-EIS)
W80-04008

PHOSPHATE CHARACTERISTICS AND BIOAVAILABILITY OF SUSPENDED SEDIMENTS FROM STREAMS DRAINING INTO LAKE ERIE,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 5B.
W80-04054

PHOSPHORUS LOADING ASSOCIATED WITH HOUSING IN A RURAL WATERSHED,
Department of Agriculture, Harrow (Ontario). Research Station.
For primary bibliographic entry see Field 5B.
W80-04055

TRIAZINE RESIDUES IN SUSPENDED SOLIDS (1974-1976) AND WATER (1977) FROM THE MOUTHS OF CANADIAN STREAMS FLOWING INTO THE GREAT LAKES,
Ontario Ministry of Agriculture and Food, Guelph (Ontario). Pesticide Residue Lab.
R. Frank, G. J. Sirons, R. L. Thomas, and K. McMillan.
Journal of Great Lakes Research, Vol 5, No 2, p 131-138, 1979. 1 Fig, 5 Tab, 20 Ref.

Descriptors: *Triazine pesticides, *Suspended solids, *Runoff, *Water chemistry, *Great Lakes region, *Canada, Sampling, Chemical analysis, Pollutants, Pollutant identification, Water pollution, Water quality, Rivers, Streams, Pesticides, Organic pesticides, Organic compounds, Atrazine, Desethylatrazine, Simazine.

Forty-five suspended solids collected during 1974 and 1976 from 12 streams on the Canadian side of the Great Lakes contained no detectable residues of triazines to a limit of 0.05 microgram/gram. Of 92 stream waters sampled in July 1977, 77% contained atrazine, 52% desethylatrazine, and 28% simazine above a detectable level of 0.03 microgram/liter. Mean concentrations of these three triazines in the 92 streams were 1.6, 0.3, and 0.2 microgram/liter, respectively. The highest mean triazine residue occurred in those stream waters entering Lake Erie (4.0 microgram/liter); there was little difference in the mean concentrations of waters entering Lakes Ontario (1.1 microgram/liter), St. Clair (1.3 microgram/liter), and Huron (1.4 microgram/liter). While triazine herbicides were found entering the Great Lakes, there was no threat to water quality as defined by the objectives of the International Joint Commission. (Sims-ISWS)
W80-04056

VOLATILE CHLORO- AND CHLOROFLUOROCARBONS IN LAKE ERIE--1977 AND 1978,
National Water Research Inst., Burlington (Ontario).
K. L. E. Kaiser, and I. Valdmanis.
Journal of Great Lakes Research, Vol 5, No 2, p 160-169, 1979. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Pollutants, *Water chemistry, *Sampling, *Chemical analysis, *Lake Erie, On-site data collections, Pollutant identification, Chemicals, Analytical techniques, Data processing, Correlation analysis, Chlorofluorocarbons, Chlorocarbons, Freon, Chloroform, Carbon tetrachloride, Trichloroethylene.

Water samples from the central and eastern basins of Lake Erie were analyzed for volatile chloro- and chlorofluorocarbons for a one-week period in each of 1977 and 1978. The following contaminants were observed with mean concentrations and standard deviations in 1978 with the corresponding values for 1977 in parentheses: dichlorodifluoromethane (Freon 12) 76 + or - 38 (73 + or - 36) nanograms/liter; trichlorofluoromethane (Freon 11) 34 + or - 26 (46 + or - 40) nanograms/liter; chloroform 15 + or - 4 nanograms/liter; carbon tetrachloride 19 + or - 11 (37 + or - 20) nanograms/liter; trichloroethylene 20 + or - 13 (11 + or - 9) nanograms/liter. Except for carbon tetrachloride and trichloroethylene, the distribution patterns appear to show little correlation with each other. Chloroform concentrations were relatively uniform, however, the carbon tetrachloride and trichloroethylene concentrations appear to be point-source related with discharges along the south shore of Lake Erie. Freon 12 concentrations were generally higher in the eastern basin than in the central basin, while Freon 11 levels were high and relatively uniform throughout the study area. (Sims-ISWS)
W80-04058

WATER-QUALITY ASSESSMENT OF RATTLESNAKE CREEK WATERSHED, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
K. F. Evans, and R. L. Tobin.
Geological Survey Water-Resources Investigations 79-17 (open-file report), April 1979. 28 p, 4 Fig, 11 Tab, 19 Ref.

Descriptors: *Water quality, *Surface waters, *Watersheds(Basins), *Ohio, *Water analysis, Sampling, Sites, Chemical analysis, Nutrients, Bacteria, Dissolved oxygen, Pesticides, Evaluation, *Rattlesnake Creek watershed(Ohio).

Chemical and biological water quality in Rattlesnake Creek basin, Ohio, are evaluated. The data include field and laboratory data for eight sites during August 1976-August 1977 and summaries of earlier (1972-76) data. Streamflow was below normal during the study period. Basin waters types were calcium bicarbonate or calcium magnesium bicarbonate. Specific conductance ranged from 405 to 1,300 micromhos per centimeter. High concentrations of sodium (110-140 mg/l), nitrogen (24 mg/l as N), and phosphorus (7.8 mg/l as P) were observed during low flows downstream from domestic sewage facilities. Nonpoint sources contributed high concentrations of nitrate-nitrogen to all streams during the high flows of winter and spring. Dissolved-oxygen concentrations in the upper basin ranged from 3.2 to 18.4 mg/l. Mean saturation values of dissolved oxygen were at or near 100 percent in the lower basin. Stream pH exceeded 8.4 when dissolved-oxygen saturation was above 120 percent. Bacteria and invertebrate data suggest that moderate pollution from cultural sources may exist in the upper basin. Water quality was poorest in the sluggish flows of the upper basin but improved downstream. Increases in flow velocity and stream aeration rates, dilution, and biological activity contributed to the downstream recovery. Except for high nitrogen concentrations, water quality was best in the lower basin. (Kosco-USGS)
W80-04091

KEEP RECREATIONAL WATERS ALGAE-FREE,
CH2M/Hill, Inc., Denver, CO.
For primary bibliographic entry see Field 5G.
W80-04116

CONSUMER REGULATION OF NUTRIENT CYCLING,
Wisconsin Univ., Madison, Lab. of Limnology.
For primary bibliographic entry see Field 5B.
W80-04122

IMPACT OF NONPOINT POLLUTION CONTROL ON WESTERN LAKE SUPERIOR, RED CLAY PROJECT, FINAL REPORT: SUMMARY,
Environmental Protection Agency, Chicago. IL. Great Lakes National Program Office.
For primary bibliographic entry see Field 2J.
W80-04181

5B. Sources Of Pollution

PHOSPHORUS CYCLING IN THE CREEPING SWAMP FLOODPLAIN ECOSYSTEM AND EXPORTS FROM THE CREEPING SWAMP WATERSHED,
North Carolina Univ. at Chapel Hill.
L. A. Yarbro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-156227, Price codes: A11 in paper copy, A01 in microfiche. PhD dissertation, (Curriculum in Ecology), December 1979. 231 p, 25 Fig, 31 Tab, 241 Ref. OWRT B-084-NC(6) and B-110-NC(2), 14-31-0001-5100, 14-34-0001-8105.

Descriptors: *Phosphorus cycling, Nutrient budget, Floodplains, Fluxes, Phosphorus retention, *Wetlands, Swamps, Ecosystems, Inflow, Discharge(Water), Phosphorus, Watersheds(Basins), *North Carolina, *Creeping Swamp(NC), Coastal plains.

Measurement of fluxes to and from a freshwater floodplain swamp ecosystem, Creeping Swamp, N.C. and from the surrounding watershed in a North Carolina coastal plain, demonstrated that the swamp floodplain and watershed budget indicated that imports and exports from fertilization and crop harvesting overwhelmed natural imports in precipitation, and exports in surface waters. The lowland location of the swamp floodplain ecosystem regulated the amount and form of phosphorus leaving the watershed in surface waters. Annual rates of exchange of filterable forms of phosphorus are extremely large compared to inputs and available stocks. This suggests that estimations are gross rather than net rates of exchange which was confirmed by comparisons of radiophosphorus-32 dynamics with changes in stable forms of phosphorus.
W80-03907

THE ENVIRONMENTAL TRANSPORT OF LEAD AND CADMIUM,
Delaware Univ., Newark. Dept. of Civil Engineering.
T. L. Willis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158033. Price codes: A08 in paper copy, A01 in microfiche. Master's Thesis, June 1978. 165 p, 24 Fig, 12 Tab, 101 Ref, 1 Append. OWRT B-018-DEL(1), 14-34-0001-8070.

Descriptors: *Cadmium, *Lead, *Delaware, *Air pollution, *Fallout, Water pollution, Rainfall, Surface runoff, Aerosols, Sampling, Spectrophotometry, Water pollution sources, Christina River.

Rainwater samples from five sites in or around the Christina River Basin near Newark, Delaware.

were collected and analyzed to study the transport of lead and cadmium in the area. Two possible sources of the pollutants in streamwater were tested to determine whether the lead and cadmium came from urban runoff of street pollutants from Newark or whether they came from atmospheric cleansing of aerosol pollutants by dry fallout and rainout. Metals analyses of all samples were carried out by flameless atomic absorption using a Jarrel-Ash Model 810 Atomic Absorption Unit. Lead analyses were performed at 2170A and cadmium analyses at 2288A. Most samples were analyzed for total metals while some were also analyzed for soluble metals and rainwater pH. Data on stream sediments and soil samples were also collected. Results indicated that the lead and cadmium found in streamwater came from atmospheric emissions. Two mechanisms were active in removing these elements from the atmosphere. During dry months dry fallout of lead and cadmium particles accumulated and were then washed off by the next rainstorm. During wet months the lead and cadmium were removed from the atmosphere by direct rainout and were then directly transported into the stream with runoff. Atmospheric lead concentrations were linked to traffic flow levels while atmospheric cadmium was found to have an industrial source. The stability of the metals in the soil system of the area was also examined. (Seigler-IPA)
W80-03914

NON-POINT SOURCE SEDIMENTATION STUDIES USING INFRARED REMOTE SENSING,
Maine Univ. at Orono.
R. S. Smith, and T. J. Keating.
Paper No 79-2506 presented at 1979 Winter Meeting of the American Society of Agricultural Engineers, New Orleans, Louisiana. December 11-14, 1979, 9 p, 2 Fig, 6 Ref, ASAE, St Joseph, Michigan. OWRT-A-049-ME(1).

Descriptors: *Aerial photography, Agricultural runoff, *Remote sensing, Suspended solids, Turbidity, *Path of pollutants.

A method was developed utilizing aerial photography to detect turbidity and suspended solids in a river from non-point source agricultural runoff. A waterway is calibrated for film response to its particular pollutant. Future overflights can then quantitatively determine turbidity and suspended solids content for environmental monitoring.
W80-03923

ORGANIC CARBON EXPORT FROM UPLAND AND FORESTED WETLAND WATERSHEDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. J. Mulholland, and E. J. Kuenzler.
Limnology and Oceanography, Vol 24, No 5, p 960-966, 1979. OWRT-B-084-NC(4), 14-31-0001-5100.

Descriptors: Carbon export, Watersheds(Basins), *Swamps, Swamp drainage, Forest drainage, Runoff, Evapotranspiration, *Forest watersheds, *Drainage, *Carbon, *Wetlands, Organic compounds, North Carolina, Canada, Massachusetts, New Hampshire, British Columbia.

Export of organic carbon per unit runoff from five small eastern North Carolina watersheds with considerable swamp drainage was severalfold higher than the export rates from upland watersheds. This reflects the higher concentrations of organic carbon, especially dissolved forms, in swamp waters and is probably attributable to increased contact time between water and organic debris as well as to concentration effects of high evapotranspiration in swamps.
W80-03925

STORM TRAVEL DISTANCE CALCULATIONS FOR TOTAL PHOSPHORUS AND SUSPENDED MATERIALS IN RIVERS,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
F. H. Verhoff, D. A. Melfi, and S. M. Yaksich.
Water Resources Research, Vol 15, No 6, p 1354-1360, December 1979. 8 Fig, 13 Ref.

Descriptors: *Phosphorus, *Suspended solids, *Storm runoff, *Model studies, Mathematical models, On-site investigations, Sampling, Rivers, Water pollution, Path of pollutants, Nutrients, Hydrographs, Runoff, Storms, Pollutants, Chemicals.

From previous work it appeared that total phosphorus is transported through rivers by a series of storm events. This paper presents a method for calculating the average distance of travel during any given storm event. The method uses the hydrograph, chemograph, and flow characteristics at a point in the river. Comparisons were made between storm events at the same station in a river, between different stations in the same river basin, and between stations in different rivers. Results showed the distance of travel is dependent upon the magnitude and duration of the storm event but not on the magnitude of the total phosphorus concentration. (Sims-ISWS)
W80-03930

A PLANNING MODEL FOR THE MANAGEMENT OF GROUNDWATER QUALITY,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
For primary bibliographic entry see Field 2F.
W80-03932

PRELIMINARY OBSERVATIONS ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF ROSS BAY, A POLLUTED AREA OF LOUGH LEANE, SOUTH-WEST IRELAND,
University Coll., Dublin (Ireland). Dept. of Zoology.
E. J. Wise, and A. O'Sullivan.
Water Research, Vol 14, No 1, p 1-13, 1980. 4 Fig, 4 Tab, 41 Ref.

Descriptors: *Bays, *Lakes, *Benthos, *Biological communities, Water quality, Water pollution effects, Water pollution sources, Biota, Aquatic life, On-site investigations, Water properties, Chemical properties, Physical properties, Biomass, Euphotic zone, Littoral, Foreign research, Analysis, Sampling, Laboratory tests, Ecosystems, Algae, *Ireland, *Ross Bay(Ireland), Microinvertebrates.

The physical, chemical, and biological water quality characteristics of Ross Bay, monitored during the period July 1974-May 1975, were described. The benthic macroinvertebrate standing crop of the littoral zone was sampled quantitatively during July 1974. The results were described in terms of biomass distribution and the distribution of taxa. The sampling stations were placed in an ordinal series based on their respective pollutional status. Changes in community structure and taxonomic composition along the series were described in terms of species diversity and the distribution of 'indicator' organisms. Based on this distribution, a scheme of biotic indices was devised in order to reduce complex community composition to simple numerical terms. For this purpose, individual organisms were given a water quality rating which is dependent on their relative tolerance or intolerance to pollution. Significant correlation was shown between the ordinal series, water quality, Diversity Index values, Community Similarity values, and Biotic Quality values. The biological evaluation of water quality in lakes was discussed, and it was suggested that the littoral benthos may serve in any future assessment of organic pollution and enrichment in Lough Leane. (Humphreys-ISWS)
W80-03934

USE OF HYPOLIMNETIC OXYGEN DEPLETION RATE AS A TROPHIC STATE INDEX FOR LAKES,
Meta Systems, Inc., Cambridge, MA.
For primary bibliographic entry see Field 2H.
W80-03954

CHARACTERIZATION OF THE WATER QUALITY IN THE SAINT LAWRENCE RIVER: DETERMINATION OF HOMOGENEOUS ZONES BY CORRESPONDENCE ANALYSIS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
For primary bibliographic entry see Field 5A.
W80-03955

MODELING GROUNDWATER FLOW FIELDS CONTAINING POINT SINGULARITIES: STREAMLINES, TRAVEL TIMES, AND BREAKTHROUGH CURVES,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-03956

HYDRAULIC EVALUATION OF A MOUND SYSTEM IN MAINE,
Maine Univ. at Orono.
K. R. Marston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158199, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, May 1979. 70 p, 22 Fig, 2 Tab, 29 Ref. OWRT A-040-ME(3).

Descriptors: *Septic tanks, *Sewage effluents, *Waste disposal, Path of pollutants, Monitoring, Subsurface flow, Mound systems, Evaluation, Alternative sewage disposal systems, On-site waste disposal systems.

Since 1974 mound systems have been an acceptable alternative for private sewage disposal in Maine. To data, there has been little information on the success or failure or on the relative performance of mounds as they are used in Maine. The objective of this research was to obtain data concerning the movement of septic tank effluent into and through the mound to help in evaluating the performance of mound systems in Maine. Well points were used to evaluate the distribution of applied effluent to the absorption trench and a neutron moisture probe was used to determine its movement through the sand fill. The test mound was monitored for a seven month period from June, 1977 to January, 1978. The 4-inch diameter pipe used in the mound did not provide uniform distribution of septic tank effluent along the length of the absorption trench. A clogged layer had formed on the bottom of the trench toward the inlet end of the distribution pipe causing effluent to pond. Below the clogged layer (that portion of the trench with ponded effluent) infiltrating effluent flowed vertically through a zone of unsaturated sand fill and then laterally through a saturated zone at the original soil surface until it was absorbed into the more slowly permeable subsoil. At no time was effluent observed seeping out of the toe of the mound on the ground surface.
W80-03962

WOOD PULP, WATER POLLUTION, AND ADVERTISING,
California Univ., Los Angeles. Dept. of History.
For primary bibliographic entry see Field 6E.
W80-03972

OPTIMIZED ECONOMIC USE OF SLUDGE TREATMENT FACILITIES IN DURBAN,
Durban City Engineer's Dept. (South Africa).
I. E. Everitt.
Journal of the Water Pollution Control Federation, Vol 51, No 3, p 494-498, March 1979. 1 Tab, 2 Ref.

Descriptors: *Optimization, *Waste water treatment, *Sludge treatment, *Costs, *Durban(South Africa), Operations research, Sludge disposal, Operating costs, Operation and maintenance, Facilities, Equipment, Capital costs, Construction costs, Filtration, Heat treatment, Economics, Cost comparisons, Economic efficiency, Africa, South Africa.

Four wastewater treatment plants in Durban, South Africa utilize several types of specialized sludge treatment units for conditioning, dewatering and disposal. Detailed descriptions are given of the technical operations of various kinds of equipment in use, including thickeners and best treatment for

sludge conditioning, centrifuging and filter plate presses for sludge dewatering, and incinerating and subsequent disposal of digested and heat-treated sludge. Thickening and centrifuging are newer treatment alternatives developed through experiences gained in modifying and evaluating plant operation. Cost comparisons of the various processes used in Durban indicates that operating costs vary widely when full use is not made of a unit (for example, if an ancillary boiler is manned 24 hr/day but is operated only a portion of that time). Capital costs of the 21 tons/day thickeners in 1976 were R240,000 (1 R = $1.147). The 1 ton/hr centrifuge unit cost in the same year was R110,000. The 1971 costs for the 950 kg/hr multiple-hearth furnace was R250,000. (Harris-Wisconsin)
W80-03979

DDE-CONTAMINATED FISH OFF LOS ANGELES ARE SUSPECTED CAUSE IN DEATHS OF CAPTIVE MARINE BIRDS,
Southern California Coastal Water Research Project, El Segundo, CA.
For primary bibliographic entry see Field 5C.
W80-03986

KINETICS OF ACCUMULATION OF SOME RADIONUCLIDES BY MARINE BACTERIA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5A.
W80-03997

BASELINE STUDY OF THE LEVEL OF CONCENTRATION OF MERCURY IN THE FOOD FISHES OF BAY OF BENGAL, ARABIAN SEA AND INDIAN OCEAN,
Marine Products Export Development Authority, Cochin (India). Inspection Lab.
For primary bibliographic entry see Field 5A.
W80-03999

ROLES OF FOOD AND SEA WATER IN THE ACCUMULATION OF RADIONUCLIDES BY MARINE FISH,
National Inst. of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
For primary bibliographic entry see Field 5A.
W80-04000

ACCUMULATION AND EXCRETION OF COBALT-60 TAKEN UP FROM SEAWATER BY MARINE FISHES,
National Institute of Radiological Sciences, Nakaminato (Japan). Div. of Marine Radioecology.
For primary bibliographic entry see Field 5A.
W80-04001

DEGRADATION OF THE CRUDE OIL BY ARTHROBACTER SP. (IN JAPANESE),
Kobe Univ. of Mercantile Marine (Japan). Research Inst. of Marine Cargo Transportation.
For primary bibliographic entry see Field 5A.
W80-04002

ACUTE TOXICITY OF SOME EXPERIMENTAL ROAD SURFACING COMPOUNDS TO DAPHNIA PULEX,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-04003

MERCURY INTERACTION IN CRAYFISH ANTENNAL GLAND AND HEPATOPANCREAS,
Boise State Univ., ID.
R. W. Ellis, and E. G. Fuller.
Journal of Invertebrate Pathology, Vol 34, p 308-309, 1979. 4 Fig.

Descriptors: *Mercury, *Toxicity, *Crayfish, Proteins, Biochemistry, Heavy metals, Animal metabolism, Spectrophotometry, Animal physiology, Cytological studies, Invertebrates, *Tissue analysis, *Bioaccumulation, *Metallothionein.

Mercury and other heavy metals have been shown to accumulate in several aquatic invertebrates. In this study four crayfish (Pasifastacus leniusculus) were exposed for 2 days to 2.5 ppm of Hg2+. The supernatants from homogenates of antennal gland and hepatopancreas were fractionated on Sephadex G-100 columns and analyzed for Hg with an atomic absorption spectrophotometer. Mercury was present in the soluble protein fraction of the antennal gland, but not in the hepatopancreas. Two fractions from the antennal gland contained Hg2+. One, representing proteins of 100,000 to 80,000 molecular weight, contained (0.18 + or - 0.02 microg (Hg)/ml fraction) and (0.28 + or - 0.02 mg (Protein)/ml fraction) and the other, representing proteins of 15,000 to 9,000 molecular weight, contained (0.30 + or - 0.05 microg (Hg)/ml fraction) and (0.02 + or - 0.005 mg (protein)/ml fraction.) This suggests that the second fraction contains a heavy metal binding protein such as metallothionein, since all reports of this protein show it to fall within this molecular weight range. Histological changes in the structures studied are also discussed. (Deal-EIS)
W80-04006

MERCURY CONTENTS OF ZOOPLANKTON COLLECTED IN THE TROPICAL PACIFIC OCEAN,
Kumamato Univ., (Japan). Aitsu Marine Biological Station.
For primary bibliographic entry see Field 5A.
W80-04007

ON THE RESISTANCE OF ISOLATED BIVALVE GILL PIECES TO OXYGEN DEFICIENCY AND HYDROGEN SULPHIDE,
Sao Paulo Univ. (Brazil). Dept. de Fisiologia Geral.
For primary bibliographic entry see Field 5C.
W80-04009

ELEMENTAL CONTENT OF AQUATIC ORGANISMS INHABITING A POND CONTAMINATED WITH COAL FLY ASH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Office of Occupational Health and Safety.
A. K. Furr, T. F. Parkinson, W. D. Youngs, C. O. Berg, and W. H. Gutenmann.
New York Fish and Game Journal, Vol 26, No 2, p 154-161, 1979. 3 Tab, 15 Ref.

Descriptors: *Industrial wastes, *Absorption, *Aquatic life, Electric powerplants, Coals, Ponds, Path of pollutants, Aquatic algae, Aquatic plants, Aquatic insects, Amphibians, Freshwater fish, Rodents, Sediments, *Aluminum, Chlorine, *Zinc, *Chromium, *Copper, Metals, Heavy metals, Trace elements, *Coal fly ash, *Selenium, *Tissue analysis, *Bioaccumulation, *Arsenic.

Using neutron activation and other methods, 39 elements were determined in algae, aquatic weeds, dragonfly nymphs, polliwogs, red-spotted newts, bullheads and muskrats from a pond contaminated by coal fly ash. The organisms contained several elements, including selenium, at concentrations markedly higher than those in controls. (Deal-EIS)
W80-04011

STUDIES ON CHEMOTHERAPY OF FISH DISEASES WITH PIROMIDIC ACID--I. ABSORPTION, DISTRIBUTION, EXCRETION AND TOXICITY OF PIROMIDIC ACID IN SOME SPECIES OF FISHES,
Dainippon Pharmaceutical Co. Ltd. (Japan) Research Lab.
H. Katae, K. Kouno, S. Morikawa, F. Tashiro, and S. Takahashi.
Fish Pathology, Vol 14, No 2, p 79-92, 1979. 1 Fig, 13 Tab, 5 Ref.

Descriptors: *Chemical properties, *Pesticides, *Fish diseases, Aquiculture, Chemical analysis, Pesticide kinetics, Pesticide residues, Absorption, Toxicity, Bioassay, Salmonids, Eels, Fish physiology, Animal metabolism, *Tissue analysis, *Ayu, *Plecoglossus, Piromidic acid, Anguilla, Pacific salmon, Oncorhynchus.

The pharmacokinetic and toxicological effects of piromidic acid (PA, 8-ethyl-5, 8-dihydro-5-oxo-2-pyrrolidinopyrido(2,3-d)pyrimidine-6-carboxylic acid) were studied in ayu Plecoglossus altivelis, amago salmon Oncorhynchus rhodurus and eels Anguilla japonica and A. anguilla. The absorption, distribution and excretion data obtained from the bioassay revealed that orally administered PA was easily absorbed and quickly became distributed in blood and major organs. Peak levels were reached in 3h (in ayu) or 6-24h (in amago salmon) after the administration of PA, followed by a gradual decrease. The levels of PA in liver and kidney were higher than in blood and plasma. In the acute toxicity study, the LD50 value for ayu was more than 2,000 mg/kg. The subacute toxicity of PA was studied in ayu (80 mg/kg), amago salmon (800 mg/kg) and eels (400 mg/kg) administered PA once daily for 5-10 days. Except for accidental death of two eels, all fishes receiving PA survived without any clinical and histopathological changes. Dissapearance of PA from the tissues in amago salmon was studied after the administration of 40 mg/kg PA for 7 consecutive days. Peak levels of PA in the tissues tested were attained within 6-12 h following administration. A level below the assay limits (0.25-0.56 ug/ml or g) was reached 96h post-dosing. No evidence of long term residue was found in any of the tissues tested. (Deal-EIS)
W80-04012

SOIL SUITABILITY FOR ON-SITE WASTE DISPOSAL: DEVELOPMENT OF GENETICALLY MARKED ESCHERICHIA COLI STRAINS AS TRACERS OF SUBSURFACE WATER FLOW,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 5E.
W80-04017

MULTIOBJECTIVE OPTIMIZATION IN WATER QUALITY AND LAND MANAGEMENT,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
P. Das, and Y. Y. Haimes.
Water Resources Research, Vol 15, No 6, p 1313-1322, December 1979. 2 Fig, 5 Tab, 34 Ref. OWRT C-7047(No 6221)(8), 14-34-0001-6221.

Descriptors: *Water quality, *Water pollution sources, *Management, *Optimization, *Ohio, Model studies, Watersheds(Basins), Erosion, Soil erosion, Phosphorus, Nutrients, Biochemical oxygen demand, Dissolved oxygen, Land use, Planning, Water pollution, Pollutants, Path of pollutants, Water pollution treatment, Land resources.

A multiobjective planning framework for a river basin that considers both point and nonpoint source pollutants was presented. The need for an integrated approach to pollution abatement originating from these two sources was discussed in the light of Public Law 92-500. The need for including multiple objective functions in their noncommensurable formats and units was also discussed. Two broad-based planning objectives considered were economic development and environmental quality. The environmental quality model included the following multiple objectives: (1) soil erosion, (2) phosphorus, (3) biological oxygen demanding load in the stream. Noninferior solutions and trade-offs among the objectives were examined for several alternative planning scenarios using the surrogate worth trade-off (SWT) method. The decision-maker's role in obtaining the basin-wide plan was discussed. Finally, the planning framework was applied to the Maumee River Basin study. (Sims-ISWS)
W80-04027

ANALYTICAL SOLUTION OF A VELOCITY DEPENDENT DISPERSION PROBLEM,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. H. Tang, and D. K. Babu.
Water Resources Research, Vol 15, No 6, p 1471-1478, December 1979. 7 Fig, 8 Ref, 3 Append. NSF-ENG-76-18957, NSF-ENG-78-24413.

Descriptors: *Dispersion, *Wells, *Injection wells, Steady flow, Porous media, Groundwater, Hydrology, Equations, Velocity, Path of pollutants, *Well hydraulics, Dispersion coefficient.

A complete description of the convective-dispersive transport of a contaminant from an injection well requires consideration of a velocity dependent dispersion coefficient. An analytical solution of this equation for steady fluid flow conditions can be obtained. The solution is significantly different from existing approximate analytical solutions. A numerical solution to this problem converges to the new analytical solution upon refinement of the finite difference net. (Lee-ISWS)
W80-04030

A NOTE ON DIFFUSION FROM A CONTINUOUS LINE SOURCE IN A TIME VARYING FLOW,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
R. E. Wilson.
Water Resources Research, Vol 15, No 6, p 1636-1638, December 1979. 1 Fig, 2 Ref.

Descriptors: *Diffusion, *Unsteady flow, *Model studies, Mathematical models, Currents(Water), Tidal waters, Dispersion, Solutes, Pollutants, Path of pollutants, Water pollution, Estuaries, Oscillating flow.

This note described approximate techniques for calculating the transient concentration field resulting from horizontal diffusion from a continuous source in a time varying flow. Using these techniques, calculations could be performed either by hand or very economically by machine. The analyses were based on a model for two-dimensional horizontal diffusion in which the field for a continuous source is represented as the superposition of the fields for instantaneous patches; the spread of an instantaneous patch is characterized by a diffusion velocity. The specific case considered was an oscillating flow characteristic of a tidal estuary, but the techniques should be of practical value in the description of concentration fields of passive quantities introduced into a variety of time varying flows. (Sims-ISWS)
W80-04037

A NOTE ON ERROR ANALYSIS FOR A PHOSPHORUS RETENTION MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 2H.
W80-04040

DIMENSIONALITY PROBLEMS IN WATER QUALITY NETWORK DESIGN,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7A.
W80-04041

WATER QUALITY SAMPLING: SOME STATISTICAL CONSIDERATIONS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Mathematical Sciences.
For primary bibliographic entry see Field 7A.
W80-04042

NON-POINT SOURCE POLLUTION FROM ABANDONED AGRICULTURAL LAND IN THE GREAT LAKES BASIN,
Michigan State Univ. East Lansing. Dept. of Crop and Soil Sciences.
T. M. Burton, and J. E. Hook.
Journal of Great Lakes Research, Vol 5, No 2, p 99-104, 1979. 3 Tab, 21 Ref. EPA R005143-01.

Descriptors: *Water pollution sources, *Agricultural watersheds, *Great Lakes region, Sampling, Nutrients, Nitrogen, Nitrogen compounds, Phosphorus, Phosphorus compounds, Calcium, Sodium, Chlorine, Suspended solids, Runoff, Agricultural runoff, Pollutants, Water pollution, Path of pollutants, *Abandoned agricultural land, Non-pointed water pollution sources.

The contribution of abandoned farm fields to non-point source pollution in the Great Lakes Basin was studied on a 7.73 ha old field watershed near East Lansing, Michigan, that had been abandoned 18 years prior to the study. Exports of nitrogen were low and approached values expected for undisturbed forests in the Great Lakes Basin. Exports of phosphorus were slightly elevated compared to undisturbed forests. Exports and concentrations of both N and P were similar to values listed for cleared, unproductive land for the Great Lakes region by the recent nationwide survey of EPA. Annual exports of total P, P04-P, N03-N, N02-N, NH4-N, Organic-N, Cl, Na, Ca, and suspended solids were given. Most exports of all constituents occurred during rainfall or snow-melt generated runoff events during the spring runoff period. Soil and soil-water nutrient concentrations were low, reflecting the low fertility of the study watershed. Nutrient concentrations in runoff reflect this low fertility and would be higher from recently abandoned farm land. The contribution of abandoned fields to nutrient loading of the Great Lakes would decrease from levels typical of agricultural runoff at time of abandonment to levels typical of undisturbed forests within 15 to 20 years following abandonment. (Sims-ISWS)
W80-04052

PHOSPHATE CHARACTERISTICS AND BIOAVAILABILITY OF SUSPENDED SEDIMENTS FROM STREAMS DRAINING INTO LAKE ERIE,
Ohio State Univ., Columbus.
T. J. Logan, T. O. Oloya, and S. M. Yaksich.
Journal of Great Lakes Research, Vol 5, No 2, p 112-123, 1979. 2 Fig, 3 Tab, 28 Ref.

Descriptors: *Suspended solids, *Phosphorus, *Nutrients, *Lake Erie, Streams, Rivers, Sampling, Chemical analysis, Analytical techniques, Watersheds(Basins), Water chemistry, Pollutants, Water pollution, Biology, Sediments, Path of pollutants, Bioavailable phosphorus.

Suspended sediments from major U.S. tributaries draining into Lake Erie were analyzed for phosphorus. Analyses included: sediment concentration, reactive and total filtered P, and total P on water samples. Recovered sediment total P was determined by perchloric and persulfate extraction. Sediment was fractionated for NaOH-P citrate-dithionite-bicarbonate (CDB)-P, HCl-P, and organic P. New York streams had the highest suspended solids and the lowest content of most sediment fractions except HCl-P. NaOH-P and CDB-P were highest in sediments from Ohio tributaries; these fractions are considered to be bioavailable with NaOH-P more available than CDB-P. Digestion with perchloric acid consistently removed more P than the persulfate method. The difference in the two methods was negatively correlated with HCl-P. (Sims-ISWS)
W80-04054

PHOSPHORUS LOADING ASSOCIATED WITH HOUSING IN A RURAL WATERSHED,
Department of Agriculture, Harrow (Ontario). Research Station.
J. D. Gaynor.
Journal of Great Lakes Research, Vol 5, No 2, p 124-130, 1979. 2 Fig, 5 Tab, 19 Ref.

Descriptors: *Phosphorus, *Bioindicators, *Domestic wastes, *Agricultural watersheds, Rural areas, Drainage, Runoff, Watersheds(Basins), Pollutants, Water pollution, Bacteria, Coliforms, Sampling, Instrumentation, Chemical analysis, Water chemistry, Water pollution sources, Housing effects.

Phosphorus and biological indicator organisms were measured in a rural watershed to quantify housing and agricultural inputs to the drainage system. Total-P and orthophosphate-P (P04-P) were significantly higher downstream from intensive housing areas than at areas with lower housing density. Housing areas discharged 40% particulate-P and 53% P04-P, while rural areas discharged 62 and 29%, respectively. On the average, rural housing contributed 2 g P/house/day which comprised 27% of the P04-P discharged from the study area. For the rural subwatersheds, phosphorus from agriculture was not differentiated from biogeochemical and precipitation inputs. Assuming all phosphorus arose from fertilizer application, total-P losses represented 3.5% of that applied, while P04-P losses represented less than 1%. It was concluded that housing in rural areas contributes P04-P to nutrient enrichment of drainage systems and that measures to control rural erosion may reduce total-P load but increase the proportion of P04-P. (Sims-ISWS)
W80-04055

TRIAZINE RESIDUES IN SUSPENDED SOLIDS (1974-1976) AND WATER (1977) FROM THE MOUTHS OF CANADIAN STREAMS FLOWING INTO THE GREAT LAKES,
Ontario Ministry of Agriculture and Food, Guelph (Ontario). Pesticide Residue Lab.
For primary bibliographic entry see Field 5A.
W80-04056

APPLICATION OF SHORT-TIME SCALE RECORDING METER DATA TO NUMERICAL MODELLING OF TORONTO HARBOUR,
Ontario Ministry of the Environment, Toronto.
D. J. Poulton.
Journal of Great Lakes Research, Vol 5, No 2, p 144-152, 1979. 10 Fig, 1 Tab, 15 Ref.

Descriptors: *Harbors, *Water circulation, *Water quality, *Canada, *Model studies, Currents(Water), Water chemistry, Temperature, Water temperature, Conductivity, Hydrogen ion concentration, Dissolved oxygen, Dissolved solids, Winds, Sampling, Analytical techniques, *Toronto Harbour.

One of the major difficulties in time-dependent numerical modeling of Great Lakes harbors is providing adequate data to describe the variation of waste discharges and open boundaries at short-time intervals (order of minutes). Short-time scale data for currents, winds, and total dissolved solids (as measured by conductivity) have been obtained at 10-minute intervals by digital recording automated equipment located at fixed points representing major discharges and connecting channels to Lake Ontario. These data have been entered directly into a two-dimensional hydrodynamic and water quality model of Toronto Harbour. The model outputs for time periods of up to 96 h were presented in the form of vector plots of currents and contour maps of water quality. The output was validated by comparison with independent short-time scale currents and water quality data measured at an interior point within the harbor, using methods of direct plotting and least-squares analysis. It is expected that refinement of physical variables in the model and measurement of verification data at closer intervals (1 or 2 min) will improve the extent of model verification. Such a model is expected to be a powerful tool in predicting the response of water bodies to management policies such as loading changes and alteration of harbor geometry. (Sims-ISWS)
W80-04057

EASTERN GULF OF MEXICO MARINE HABITAT STUDY. VOLUME I.
Woodward-Clyde Consultants, Orange, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 152, Price codes: A06 in paper copy, A01 in microfiche. Final Report to Bureau of Land Management, January 1979. 111 p, 3 Fig, 2 Tab, 2 Append. AA551-CT8-22.

Descriptors: *Baseline studies, *Gulf of Mexico, *Florida, *Habitats, *Resources development, Environmental effects, Ecology, Water pollution sources, On-site investigations, Oil pollution, Leases, Oil fields, *Outer Continental Shelf, Environmental impact.

The primary objective of the Eastern Gulf of Mexico Marine Habitat Study was to identify and delineate marine habitat areas in 49 of the proposed lease blocks included in OCS Sale No. 65. The

lease blocks are located offshore Florida in the Gulf of Mexico. The 49 blocks were divided into 10 non-contiguous map areas for the purposes of discussion and data presentation. The ground truth and geophysical data were reviewed to identify potentially critical marine habitat areas where further studies may be desired prior to initiation of any offshore operations that could affect the marine habitat. The majority of the areas studied have a 'soft bottom'. Most of the biotic activity is associated with the soft bottom which varies considerably in character and biotic productivity. The soft bottom areas represent a prime resource and must be considered in proper perspective before any judgements about the ecological and economic impacts of the lease sale can be made. (See also W80-04077) (Sinha-OEIS)
W80-04076

EASTERN GULF OF MEXICO MARINE HABITAT STUDY. VOLUME II: MAPS AND CROSS SECTIONS.
Woodward-Clyde Consultants, Orange, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 153, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Bureau of Land Management, January 1979. 28 p. AA551-CT8-22.

Descriptors: *Baseline studies, *Gulf of Mexico, *Florida, *Habitats, Resources development, On-site investigations, Leases, Oil fields, *Outer Continental Shelf, Environmental impact.

Volume 2 of the Eastern Gulf of Mexico Marine Habitat Study consists of an index map, navigation post plots, bethymetry and sea floor sediment characteristics maps, and 3 sheets of geologic cross sections. (See also W80-04076) (Sinha-OEIS)
W80-04077

EFFECTS OF LANDFILL LEACHING ON WATER QUALITY AND BIOLOGY OF A NEARBY STREAM, SOUTH CAIRO, GREENE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. A. Ehlke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 776, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey, Water-Resources Investigations 79-13, 1979. 18 p, 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Landfills, *Leachate, *Infiltration, *Water quality, *Waste disposal, *Biology, Streamflow, New York, Reach(Streams), Analytical techniques, Chemical analysis, Documentation, Observation wells, Sampling, Data collections, Groundwater, Surface waters, Benthic fauna, Invertebrates, Aquatic populations, Microorganisms, Inflow, Heavy metals, Algae, Bacteria, Path of pollutants, *Greene County(NY), Bell Brook.

A 1-kilometer stream reach receiving leachate-enriched water from a small municipal landfill in Greene County, N.Y., was studied from 1971-75 to document streamflow rates and chemical quality of the stream and ground water. The distribution of benthic invertebrates and microorganisms in the stream above the landfill was markedly different from that below it; the difference is attributed to the inflow of leachate. The Trichoptera, Ephemeroptera, and Nematomorpha have been eliminated from the reach adjacent to and below the landfill and have been replaced by large numbers of Tendipedidae and Niadidae. Certain chemical constituents, especially iron and manganese, were extremely concentrated in the ground water immediately beneath the streambed. The elevated concentrations of these and other metals may be the direct cause of the abrupt faunal shift. Algae were replaced by large masses of the iron bacterium Leptothrix in the stream reach below the landfill. (Kosco-USGS)
W80-04092

STATISTICAL ANALYSIS OF NITRATE CONCENTRATIONS FROM THE RIVER FROME (DORSET) FOR THE PERIOD 1965-76,
Freshwater Biological Association, Wareham (England). River Lab.
H. Casey, and R. T. Clarke.
Freshwater Biology, Vol 9, No 2, p 91-97, April 1979. 6 Fig, 7 Tab, 15 Ref.

Descriptors: *Nitrates, *River Frome(UK), United Kingdom, *Statistics, Statistical methods, Regression analysis, Discharge(Water), Correlation analysis, Seasonal, Annual, Cycling nutrients, River flow.

Model predictions for 1976 nitrate concentrations (mean 3.37 mg) in the River Frome, England, based on 11 years (1965-1975) weekly data of nitrate concentrations and discharge values, were very close to the 3.44 mg observed mean nitrate concentrations. 1976 results showed 1.5 mg nitrate minimum concentration in August, followed by 7.24 mg concentration only seven weeks later. The model poorly fit seasonal 1976 variation due to a dry preceding winter, summer drought until September, and heavy rainfall in early winter. Data from 1965-1975 showed weekly mean peaks in early February, low values in summer and high values in winter, following a cosine wave. 84% of yearly mean variation is explained by a linear regression on time. A 0.107 regression coefficient estimates average annual increase in nitrate concentration between 1965-1975. No overall trend occurred in flow rates over the years, although mean annual 1966-1968 flows were significantly higher than other years. Although discharge closely relates to seasonal nitrate variation when based on weekly data averaged over several years, individual discharges and nitrate concentrations relate less closely because both vary considerably and independently over one week. Nitrate was determined by the phenol disulphonic acid method. (Danovich-Wisconsin)
W80-04101

CCE-M VALUES OF NATURAL AND RECHARGED GROUNDWATERS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
K. L. Knickerbocker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160856, Price codes: A05 in paper copy, A01 in microfiche. M.S. Report, 1976. 68 p, 6 Fig, 8 Tab, 31 Ref. OWRT A-067-ARIZ(2), 14-34-0001-6003.

Descriptors: *Water quality, *Groundwater, *Waste water(Pollution), *Reclaimed water, *Groundwater recharge, Organic compounds, Trace elements, Dissolved solids, Public health, Water wells, Potable water, Standards, CCE-m, Groundwater organics, Wastewater recharge, Groundwater quality.

The total organic content or recharged secondary effluents as measured by the miniaturized carbon chloroform extract method (CCE-m) was investigated by analyzing waters from wells located at various distances from recharge areas. It was found that the CCE-m organic concentration decreased with increasing percolation distance. Secondary activated sludge effluent was found to contain 3.80 mg/l CCE-m. Percolation through 100 feet of porous media reduced the CCE-m value to less than 0.50 mg/l. This is less than the E.P.A. proposed 1974 Drinking Water Standard of 0.70 mg/l. Fourteen wells located a minimum of 1,000 feet from an ephemeral stream receiving secondary effluent had CCE-m values less than 0.20 mg/l. A general survey of deep wells known not to receive any wastewater recharge found CCE-m values varying from 0.04 to 0.30 mg/l. It is probable that the oil lubrication methods employed in deep wells resulted in these CCE-m values.
W80-04110

SEASONAL VARIATION IN THE POPULATIONS OF MOINA MACROCOPA STRAUSS AND MOINA MICRURA KURZ (CRUSTACEA: CLADOCERA) IN ZOAFARANIYAH POOLS,
Biological Research Centre, Baghdad (Iraq).
A. N. Khalaf, and A. F. Shihab.
Hydrobiologia, Vol 62, No 1, p 75-77, January 1979. 2 Tab, 9 Ref.

Descriptors: *Crustaceans, *Seasonal, *Population dynamics, *Reproduction, *Zoafaraniyah pools, Iraq, Invertebrates, Population, Water temperature, Temperature, Physiochemical properties, Speciation, Animal behavior, Animal physiology, Animal metabolism, Life history studies, Life cycles, On-site investigations.

A clear difference exists between two cladoceran species in Zoafaraniyah pools, Iraq, as measured in July 1976-June 1977; Moina macrocopa has one developmental cycle, whereas Moina micrura has a cicyclic development. Both species reach a maximum in October when temperatures are 22-28.5C. M. macrocopa density reaches 11,815/l. During winter months population density gradually declines to 73/l in December. M. micrura population peaks in October and April, amounting to 13,125/l and 11,000/l, respectively. Both species completely disappear in January when temperatures are 4-9C. However, M. micrura occurs in the field five to six months earlier than M. macrocopa does. Reproduction does not occur for either species in July, indicating a response to high temperatures. M. macrocopa reproduction takes place September-December while M. micrura reproduction occurs March-July and August-December. (Danovich-Wisconsin)
W80-04121

CONSUMER REGULATION OF NUTRIENT CYCLING,
Wisconsin Univ., Madison, Lab. of Limnology.
J. F. Kitchell, R. V. O'Neill, D. Webb, G. W. Gallepp, and S. M. Bartell.
BioScience, Vol 29, No 1, p 28-34, January 1979. 5 Fig, 2 Tab, 82 Ref. NSF AG-199, ERDA BMS 76-00761.

Descriptors: *Cycling nutrients, *Secondary productivity, *Translocation, *Animal behavior, *Food habits, Nutrients, Ecosystems, Distribution, Vertical migration, Fish, Biomass, Insects, Biological communities, Sediment-water interfaces, Mixing, Energy budget, Food chains, Cycles, Aquatic productivity, Predation, Zooplankton.

Nutrient-cycling rates in ecosystems are altered by translocation and transformation which result from consumer organism behavior and consumption processes. Consumers have been simply represented as components in energy-flow patterns; however, they substantially influence nutrient cycling through physical/chemical processes, mainly by translocation and transformation. Consumer translocation is an important ecosystem-level process because animal mobility and behavior affect nutrient redistribution across subsystem boundaries. Diel vertical migration by zooplankton causes rapid nutrient translocation. In aquatic systems, fish represent the most mobile form of phosphorus and concentrate the mineral four-fold over other biomass pools. Nutrient cycling due to biological distrubance at sediment-water interfaces is great because massive phosphorus pools are stored in sediments. Over time, consumers transform the surface/volume relationship of their prey community or food substrate in ways that alter nutrient cycling processes. In aquatic ecosystems, selective predation alters the size spectrum of particles. The keystone role of soil arthropods in litter transformation involves comminution, or reduction in particle size. In decomposing tree boles, channelization by termites, ants and beetles, significantly transforms physical/chemical processes. Small units are also aggregated such as in macroarthropod feces or fish biomass, resulting in nutrient conservation. (Danovich-Wisconsin)
W80-04122

APPLYING PHOSPHORUS LOADING MODELS TO EMBAYMENTS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. C. Chapra.
Limnology and Oceanography, Vol 24, No 1, p 163-168, January 1979. 2 Fig, 1 Tab, 20 Ref

Descriptors: *Saginaw Bay, *Bays, *Phosphorus, *Cycling nutrients, *Model studies, *Turbulent

flow, Lake Huron, Great Lakes, Gulfs, Inlets, Eutrophication, Sounds, Vollenweider models, Mixing, Advection, Nutrient loading, Nutrients, Nutrient transport, Mathematical models, Turbulence, Nutrient budgets.

Most phosphorus loading models have been applied to lakes where advection through river outlets is the predominant form of mass transport out of the system. This paper develops a simple loading model for bays which can be considered as completely mixed systems when a turbulent mass transport term is added to a nutrient budget equation. The model is demonstrated for use with Saginaw Bay, Lake Huron. A method is devised to incorporate turbulent diffusion into loading plots by adjusting loading terms to include phosphorus flux from Lake Huron into the bay and including turbulent flow effects in residence time. Physical and chemical data for the system (Saginaw Bay, its tributaries and Lake Huron) as measured during 1974-76 are utilized in an equation to yield a bulk diffusion coefficient. Calculation of total phosphorus concentration requires an estimate of apparent settling velocity, estimated here at 12.4 m/yr as derived from phosphorus budget data from a number of other lakes. On the basis of calculations employing the suggested model, a total phosphorus budget is given: of an estimated 1,443 t/yr coming into the bay from direct loadings and tributaries, 38% is incorporated into the sediments, 16% leaves by advection, and 46% leaves by turbulent mixing; thus, inclusion of the turbulent mixing process in the loading model accounts for nearly half the phosphorus outflow from Saginaw Bay. (Harris-Wisconsin)
W80-04123

DISTRIBUTION OF POLLUTANTS FROM A NEW PAPER PLANT IN SOUTHERN LAKE CHAMPLAIN, VERMONT AND NEW YORK,
Michigan Univ., Ann Arbor. Dept. of Natural Resources.
D. L. Mason, D. W. Folger, R. S. Haupt, R. R. McGirr, and W. H. Hoyt.
Environmental Geology, Vol 1, No 6, p 341-347, May 1977. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Lake Champlain, *Pulp and paper industry, *Pollutant identification, *Pulp wastes, *Sediments, Pollutants, Suspended load, Suspended solids, Sediment discharge, Water pollution sources, Water pollution treatment, Lake beds, Phosphorus, Wood wastes, Organic wastes, Carbon, Kaolinite, Organic loading, Water pollution effects.

Water column and bottom sediments collected November 1973-May 1974 near the outfall of a new paper plant located on Lake Champlain's western shore and opened in June 1971 contained measurable quantities of components derived from the pulp and paper mill despite extensive treatment to reduce such pollutants. Recovered detritus and near-bottom sediments were analyzed for materials used in paper manufacturing, such as kaolinite (paper filler), anatase (paper whitener), organic carbon (derived from wood fibers) and phosphorus (added in treatment processes). As much as 2.3 cm of sediment accumulated during the six-month monitoring period near the new mill outfall whereas less than 1 cm accumulated in all other areas sampled. Kaolinite/chlorite values in trap sediments were highest (1.4%) at the plant outfall as well as anatase concentrations (0.8%). Organic carbon concentrations were highest in both traps (8.7%) and bottom sediments (4.2%) near the mill outfall. Similarly, extractable phosphorus concentrations in trap sediments (254 micro g/g) and bottom sediments (127 micro g/g) were highest near the outfall. All values for these components remained high 1.5-6 km to the north. Values were significantly lower in most other areas sampled in southern Lake Champlain. Extensive primary and secondary waste treatment facilities including tanks, lagoons and clarifers were constructed to process the 62,000 cu m daily wastewater discharge; however, additional effluent treatment is still necessary. (Danovich-Wisconsin)
W80-04126

PLANNING FOR NONPOINT POLLUTION CONTROL IN NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
L. A. Brown.
Journal of Soil and Water Conservation, Vol 34, No 1, p 8-10, January-February 1979. 2 Tab, 5 Ref.

Descriptors: *North Carolina, *Nonpoint pollution, *Planning, *Agricultural runoff, *Erosion control, *Federal Water Pollution Control Act Amendments of 1972, Erosion, Water quality, Soil erosion, Water pollution, Water pollution sources, Water pollution control, Soil conservation, Costs, Erosion rates, Farms, Agriculture, Soil management, Federal Water Pollution Control Act.

Responsibility for nonpoint pollution control program planning on agricultural land in North Carolina was delegated to the Soil and Water Conservation Commission, which coordinates the Agricultural 208 Planning Group. The 208 Planning Group developed a three-phase study plan. As part of Phase I, a statewide inventory of erosion was conducted for different land uses. During Phase II, sub-basins with high pollution potential were investigated to determine which nonpoint pollutants were present, their source and the best management practices (BMPs) needed to control them. Phase III involved continued study and monitoring of two priority sub-basins. Highest erosion rates occur on surface mines, sanitary landfills, construction sites and shorelines; however, almost two-thirds of the state soil loss occurs from cropland. The highest sediment delivery rates occur in the Piedmont and mountain state areas. Almost half of the erosion occurs on 2.3 million acres of high water erosion hazard cropland. This means that over 36 million tons of the state's annual soil loss of 79 million tons comes from 7.4% of the land. The proposed multi-year program includes BMPs to reduce erosion on cropland to 5 tons/acre/yr. Installing and maintaining these BMPs will cost an estimated $281 million as of October 1978. On-site costs of installing these practices average $75/acre. North Carolina landowners now spend $9 million/yr to install erosion and sediment control practices. Even with active cost-sharing government programs, less than half the needed $28 million/yr is being provided. (Danovich-Wisconsin)
W80-04130

PHOSPHATASE ACTIVITY AND ITS ROLE IN THE MINERALIZATION OF ORGANIC PHOSPHORUS IN COASTAL SEA WATER,
Tokyo Univ. (Japan). Ocean Research Inst.
For primary bibliographic entry see Field 5F.
W80-04141

MARS - A NEW INSTRUMENT FOR MEASURING PHYTOPLANKTON SINKING RATE,
Oceanic Inst., Waimanalo, HI.
For primary bibliographic entry see Field 7B.
W80-04142

THE ECOSYSTEM APPROACH; SCOPE AND IMPLICATIONS OF AN ECOSYSTEM APPROACH TO TRANSBOUNDARY PROBLEMS IN THE GREAT LAKES BASIN.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Science Advisory Board.
For primary bibliographic entry see Field 6E.
W80-04159

5C. Effects Of Pollution

ORGANIC CARBON CYCLING IN A SWAMP-STREAM ECOSYSTEM AND EXPORT BY STREAMS IN EASTERN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. J. Mulholland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160658, Price codes: A08 in paper copy, A01 in microfiche. Ph.D Dissertation, 1979. 152 p, 31 Fig, 37 Tab. OWRT B-084-NC(5) and B-110-NC(1), 14-31-0001-5100, 14-34-0001-8105.

Descriptors: Organic carbon concentration, Organic carbon flux, Carbon export, Organic carbon budget, Swamp ecosystem, Biological inputs, Biological outputs, Streams, Hydrologic inputs, Hydrologic outputs, Channelized streams, *Swamps, *Carbon, *Organic compounds, *Ecosystems, *North Carolina, Creeping Swamp(NC), Creeping Swamp watershed(NC), Organic carbon concentrations.

Organic carbon concentrations were monitored in 7 small N.C. streams, 4 of which had been channelized. Seasonal patterns of organic carbon concentrations were different between channelized streams and natural swamp-streams; however, there was overlap in weighted mean annual organic carbon concentrations. Major inputs, outputs and internal ecosystem flows of organic carbon cycling processes in Creeping Swamp were measured, and the annual organic carbon budget was made for 1977. Export of primarily dissolved organic carbon from Creeping Swamp varied seasonally. Annual exports from this and the other streams were linearly related to annual runoff. These exports were larger than upland watersheds probably as a result of increased contact time between ground litter and surface water and evapotranspiration in swamp ecosystems. It is hypothesized that organic carbon export is important to downstream secondary productivity, especially in estuaries. (DiNardi-NC)
W80-03906

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY: CHLORINE AND OZONE TOXICITY EVALUATION,
Rice Univ., Houston, TX. Dept. of Biology.
B. Hammond, and J. Bishop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-131121, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-050e, August 1979. 47 p, 19 Fig, 3 Tab, 17 Ref. 802433.

Descriptors: *Chlorination, *Ozone, *Channel catfish, *Waste water treatment, Toxicity, Bioassay, Lethal limit, Fish physiology, Environmental effects, Fish toxins, Disinfection, Analytical techniques, Water pollution sources, Gills, Kidneys, The Woodlands.

Fingerling channel catfish, Ictalurus punctatus, were used in bioassays to study the effects on aquatic organisms of waste water disinfection by chlorine and/or ozone as part of an evaluation of the water resources plan for The Woodlands, a planned urban development. The Woodlands, located near Houston, Texas, is designed so that impoundments in the community that will be used for recreational fishing will receive reclaimed waste water. Both flow through and standard static bioassays were conducted and compared to determine an accurate LC50 for chlorine while a flow through bioassay alone was used for the ozone. Fish used in the study underwent cannulation and catheterization to facilitate monitoring of gill and kidney functions. Results show that the flow through bioassay for chlorine produced a lower 96 hour LC50 than did the static bioassay, with an LC50 of 0.07 mg/l chlorine for the flow through versus an LC50 of 0.45 mg/l chlorine for the static bioassay. From these values and considerations of the techniques used it is concluded that the final concentration of chlorine in receiving waters should not exceed 0.007 mg/l. Ozone was more toxic to fingerlings than chlorine with a 96 hour LC50 of 0.03 mg/l. From this value and the highly reactive nature of ozone it is concluded that if ozone can be detected either by analytical techniques or by its odor it exceeds safe environmental limits. Both disinfectants had little effect on kidney functions but both drastically reduced the ability of gills to absorb sodium from water. Long term exposure to ozone had little effect on blood pressure and heart rate while long-term chlorine exposure greatly reduced both. (Seigler-IPA)
W80-03921

POLYCHLORINATED BIPHENYLS: PHYTOTOXICITY, ABSORPTION AND TRANSLOCA-

TION BY PLANTS, AND INACTIVATION BY ACTIVATED CARBON,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
J. B. Weber, and E. Mrozek, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 412-417, 1979. 4 Tab, 15 Ref. OWRT-B-122-NC(1), 14-34-0001.

Descriptors: *Polychlorinated biphenyls, *Activated carbon, *Plant growth, Plant uptake, Hazardous waste, Chlorinated hydrocarbon, Toxic substance, Waste treatment, Soil absorption, Toxicity, *PBC spills, North Carolina.

A large spillage of polychlorinated biphenyls (PCBs) in North Carolina stimulated this investigation which (1) examined the effects of soil-applied PCB on soybean and fescue growth, (2) determined the amount of PCB absorbed and translocated by the 2 plant species, and (3) determined if activated carbon would inactivate PCB and prevent its uptake by plants. Results indicate that PCB applied to soil significantly inhibited height and fresh top weight of soybean plants at high application rates. Leaf malformation was also observed. Activated carbon added to the soil removed the inhibitory effects of PCB at all rates of application.
W80-03924

FEATURES OF THE STRUCTURE AND TROPHIC LINKS OF PLANKTONIC ASSOCIATIONS IN TWO LAKES WITH DIFFERNET DEGRESS OF SALINITY,
Akademiya Nauk SSSR, Moscow. Inst. of Limnology.
V. G. Drabkova, G. I. Letanskaya, and E. S. Makartseva.
The Soviet Journal of Ecology, Vol 9, No 1, p 68-73, January-February 1978. 4 Tab, 21 Ref.

Descriptors: *Plankton, *Lakes, *Salinity, *Trophic level, *Biomass, Phytoplankton, Bacterioplankton, Zooplankton, *USSR, Lake B. Shentropai(USSR), Decomposing organic matter, Lake Atkul(USSR), Ural Mountains(USSR), Saline water, Saline lakes, Ions, Sampling, Ecology, Ecosystems, Biodegradation, Degradation(Decomposition), Food webs.

Ecological production characteristics of phytoplankton, bacterioplankton and zooplankton were studied for two forest-steppe lakes in the southern Ural Mountains region of the USSR in Chelyabinsk Province, May-October, 1974. Plankton sampling comparative analysis shows that with increasing water salinity, impoverishment of species composition occurs for phytoplankton and zooplankton, zooplankton biomass rises sharply as compared with phytoplankton and bacterioplankton, and feeding interrelationships between these associations become more strained. Algae bacteria cannot satisfy zooplankton food requirements. Low phytoplankton and bacterioplankton biomass in a mineralized lake is caused by domination of small algae and bacteria forms. With increased salinity, zooplankton plays a greater role in organic matter decomposition. Lake Atkul' and Lake B. Shantropai, located 9 km apart, are characterized by shallow depths and high exposure; the lakes differ sharply in hydrochemical indices and above all in the total of basic ions. Zooplankton is much more important in the Lake B. Shentropai ecosystem (total ions up to 16 g/l) compared to Lake Atkul' (2.5 g/l). Moreover, its importance is almost doubled in the presence of decomposing organic matter; pressures of feeding interrelationships simultaneously increases zooplankton importance. Zooplankton biomass in Lake B. Shantropae exceeds phytoplankton biomass by more than 10 times and bacterioplankton biomass by more than four times. (Harris-Wisconsin)
W80-03963

STUDIES ON THE PLANT COMMUNITY OF A NORTH FLORIDA SALT MARSH PART II. NUTRITIVE VALUE AND DECOMPOSITION,
Florida Agricultural and Mechanical Univ., Tallahassee.
W. L. Kruczynski, C. B. Subrahmanyam, and S. H. Drake.
Bulletin of Marine Science, Vol 28, No 4, p 707-715, October 1978. 2 Fig, 4 Tab, 22 Ref. DOAg 416-15-15.

Descriptors: *Salt marshes, *St. Marks(FL), *Halophytes, *Spatial distribution, *Decomposing organic matter, Spartina alterniflora, Leaves, Plant physiology, Plant morphology, Biochemistry, Rhizomes, Biodegradation, Speciation, Carbohydrates, Proteins, Juncus roemerianus, Distichlis spicata, Chemical analysis, Distribution patterns, Florida.

This study summarizes zonal variations in nutritive values of live, dead and decomposing plants in tidal marshes near St. Marks, Florida September 1974-August 1975. Juncus roemerianus and Spartina alterniflora shoots and Juncus rhizomes were sampled bimonthly in each of three marsh zones: low (LM), upper (UM) and high (HM) zones. Distichlis spicata was sampled only in HM. Ash content of Juncus leaves and rhizomes decreases from LM toward HM, reflecting adaptations to soil gradients. Caloric value, lipid and protein content of live Juncus leaves are smallest in UM, indicating that nitrogen may be limiting in UM zones. Juncus rhizomes have a higher percentage of ash and carbohydrate than leaves. Spartina nutrient zonal variations are significant; leaf protein content is lowest in UM, ash content is greatest in HM. Spartina has higher ash contents than Juncus in all areas. Distichlis protein and lipid content is lower than that of either live Juncus or Spartina, while Distichlis carbohydrate is higher than both. Concentrations of Fe and B in live Juncus leaves increase from LM to HM, while concentrations of Na, Al and Mo are highest in LM leaves. Spartina concentrations of K, Al, Mo and Fe increase toward LM, while Mg increases toward HM. Concentrations of most amino acids are greatest in LM and lowest in UM plants. Juncus annual decomposition is 70% in LM and UM and 30% in HM; Spartina litterbags loose 80-89% of weight at all marsh sites. (Danovich-Wisconsin)
W80-03975

ENVIRONMENTAL ASPECTS OF OCEAN DUMPING IN THE WESTERN GULF OF MEXICO,
Texas A and M Univ., College Station.
E. Atlas, J. Brooks, J. Trefry, T. Sauer, and C. Schwab.
Journal of the Water Pollution Control Federation, Vol 52, p 329-350, 1980. 13 Fig, 10 Tab, 33 Ref.

Descriptors: *Sewage sludge, *Sewage disposal, *Gulf of Mexico, Chemical properties, Biodegradation, Microbial degradation, Bacteria, Industrial wastes, Chemical wastes, Heavy metals, Organic compounds, Productivity, Toxicity, Phytoplankton, Turbidity, Water chemistry, Waste disposal, Oceans.

Field and laboratory studies were conducted of an ocean-dumped waste containing biological sludge from a chemical biotreatment plant. During July 1977, a test dump was monitored to study the chemical behavior and dispersal of waste at a deep-water dumpsite in the western Gulf of Mexico. Nearly 100 organic compounds were detected in the waste, and some heavy metals were measured in significant amounts. At the diluted levels usually encountered in the ocean, adverse effects of such a waste on phytoplankton productivity would not be measurable with the techniques used. Increased turbidity and chemical residues could not be measured in the field past 24 hours. (Deal-EIS)
W80-03980

FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS--V THE TOXICITY OF THE GELLING COMPOUNDS FOR PETROLEUM TO MARINE ORGANISMS (IN JAPANESE),
Tokyo Univ. (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W80-03981

HEAVY METAL TOLERANCE OF MARINE PHYTOPLANKTON. IV. COMBINED EFFECT OF ZINC AND CADMIUM ON GROWTH AND UPTAKE IN SOME MARINE DIATOMS,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
For primary bibliographic entry see Field 5A.
W80-03982

HEAT RESISTANCE OF CELLS OF UPPER SUBLITTORAL BIVALVE MOLLUSKS OF SANDY INFAUNA IN PETER THE GREAT BAY (SEA OF JAPAN),
Akademiya Nauk SSSR, Vladivostok. Inst. Morskogo Biologii.
V. S. Vasil'eva.
The Soviet Journal of Marine Biology, Vol 4, No 1, p 523-526, 1978. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Mollusks, *Heat resistance, *Water temperature, *Bills, *Sea of Japan, Peter the Great Bay(USSR), Animal physiology, Benthic fauna, Spatial distribution, Thermal stratification, Adaptation, Toxicity, Cytological studies.

The author determines the heat resistance of eight species of bivalve mollusks of sandy infauna of the upper sublittoral of Peter the Great Bay (USSR). Specifically, the heat resistance of cells of ciliated epithelium of mollusk gills was examined. As is the case in bottom invertebrates of epifauna, the differences in heat resistance of species of infauna mollusks are in conformance with their vertical and geographical distribution and their environmental temperatures. (Deal-EIS)
W80-03983

THE BACTERIAL FLORA OF CERTAIN MARINE FISHES AND PRAWNS IN COCHIN WATERS IN RELATION TO THEIR ENVIRONS,
Central Inst. of Fisheries Technology, Cochin (India).
T. C. Karthiayani, and K. M. Iyer.
Journal of the Marine Biological Association of India, Vol 17, No 1, p 96-100, 1975. 2 Tab, 10 Ref.

Descriptors: *Marine bacteria, *Spatial distribution, *Tissue analysis, *Achromobacter, *Vibrio, *Prawns, *Sardines, *India, Pseudomonas, Bacteria, Cultures, Chemical analysis, Cytological studies, Bottom sediments, Lobsters, Seasonal, Depth, Biological communities.

Commercially important fishes like sardines, prawns, lobster and seer fish caught off Cochin, sea water samples gathered from different depths (surface, middle and bottom) and bottom mud were subjected to bacteriological analysis. Qualitatively the predominant organisms found associated with these marine animals were the gram negative, asporogenous, rod-like bacilli of the genera Pseudomonas, Achromobacter and Vibrio. Sea water and bottom mud samples also showed a predominance of gram negative rods, though with considerable variation in generic composition with depth. Quantitatively the 'bacterial density' of the sea water increased with depth, the highest aerobic count being shown by bottom mud and the least by surface water up to 14 meters depth. Compared to bottom mud, a 10 to 100 fold increase in the bacterial count was observed on the body of the fishes in general and a higher increase (10 to the third power to 10 to the fourth power fold) at the gills and the highest (10 to the fourth power to 10 to the fifth power fold in the guts of sardines have been constantly recorded. The significance of the observation has been discussed in relation to the keeping quality of the fish. (Deal-EIS)
W80-03984

EFFECT OF HEXACHLORAN ON OXYGEN CONSUMPTION OF NEOGOBIUS MELANOSTOMUS AND NEOGOBIUS FLUVIATILIS,
Odessa State Univ. (USSR). Dept. of Hydrobiology.
F. C. Zambriborshch, and B. I. Ai
The Soviet Journal of Marine Biology, Vol 4, No 1, p 526-529, 1978. 4 Fig, 4 Tab, 8 Ref.

Descriptors: *Oxygen requirements, *Fish physiology, *Pesticide toxicity, *Hexachloran, *Neogobius, Respiration, Animal metabolism, Chemical analysis, Oxygen, Chlorinated hydrocarbon pesticides, Fish populations, Water pollution effects

The effect of hexachloran on oxygen consumption of Neogobius melanostomus and N. fluviatilis is investigated. The investigation shows that this pesticide in concentrations lower than the maximum permitted (0.006-0.012 mg/liter) affects respiration and intensifies the 'group effect' in oxygen consumption. The ability to restore respiration disrupted by the pesticide was the same in these fishes. Those poisoned by hexachloran in concentrations of 0.006 and 0.012 mg/liter were unable to restore oxygen consumption to normal for a period of up to no less than three days. (Deal-EIS)
W80-03985

DDE-CONTAMINATED FISH OFF LOS ANGELES ARE SUSPECTED CAUSE IN DEATHS OF CAPTIVE MARINE BIRDS,
Southern California Coastal Water Research Project, El Segundo, CA.
D. R. Young, T. C. Heesen, G. N. Esra, and E. B. Howard.
Bulletin of Environmental Contamination and Toxicology, Vol 21, p 584-590, 1979. 3 Tab, 12 Ref.

Descriptors: *Pesticide toxicity, *DDT, *Mortality, *Cormorants, *Tissue analysis, Gulls, Pesticide residues, Chlorinated hydrocarbon pesticides, Path of pollutants, Food chains, *DDE, Polychlorinated biphenyls, Gas chromatography, California, Los Angeles Zoo.

During the spring of 1976, nearly the entire collections of Brandt's cormorants (Phalacrocorax penicillatus), guanay cormorants (P. bougainvillii), and California gulls (Larus californicus) in the Los Angeles Zoo died after exhibiting signs of pesticide poisoning. In view of the extensive DDT pollution which has occurred in the coastal waters off southern California, we conducted a limited investigation to determine if this pollutant could have been the cause of death for these specimens of marine birds. The study revealed that concentrations of DDT residues in the specimens were within the range that had been found to be lethal to American kestrels in laboratory feeding studies. The zoo birds apparently were exposed to high levels of these residues when they were fed marine fish collected near Los Angeles. (Deal-EIS)
W80-03986

HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: HAEMOGLOBIN ELECTROPHORESIS, ATP LEVELS AND CORPUSCULAR FRAGILITY CURVES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03988

HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTRASPECIES DIFFERENCES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
G. L. Smit, J. Hattingh, and A. P. Burger.
Journal of Fish Biology, Vol 15, p 645-653, 1979. 4 Tab, 11 Ref.

Descriptors: *Toxicity, *Fish physiology, *Organic compounds, Carp, Rainbow trout, Freshwater fish, Acids, Hydrogen ion concentration, Animal metabolism, Acid-base equilibrium, Mode of action, Chemical properties, *MS222, *Anaesthetics, *Fish anaesthetics, *Sarotherodon, *Blood chemistry, *Tissue analysis

The effects of different concentrations of natural MS222 and neutralized MS222 were studied on the haematology of Cyprinus carpio, Sarotherodon mossambicus and Salmo gairdneri. As judged from the results, MS222, which is acidic in nature, produced haemoconcentration effects in all species studied, being least in the trout followed by carp and Sarotherodon mossambicus. These differences are ascribed to acid-base regulatory functions and metabolic activities of the fish species investigated. The use of neutralized MS222 improved the haematological profiles markedly and resulted in stabilization of acid-base parameters and red blood cells sizes and numbers. Haemoconcentration effects, however, still persisted. Trout were found to be more susceptible to the stress of MS222 anaesthesia than carp and Sarotherodon mossambicus. (Deal-EIS)
W80-03989

HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTERSPECIES DIFFERENCES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
G. L. Smit, J. Hattingh, and A. P. Burger.
Journal of Fish Biology, Vol 15, p 633-643, 1979. 6 Tab, 18 Ref.

Descriptors: *Toxicity, *Fish physiology, *Organic compounds, Carp, Rainbow trout, Freshwater fish, Chemical properties, Mode of action, Animal metabolism, Fish management, *Sarotherodon, *MS222, *Anaesthetics, *Fish anaesthetics, *Tissue analysis, *Blood chemistry.

Interspecies haematological differences to MS222 and neutralized MS222 anaesthesia were investigated in Sarotherodon mossambicus. Cyprinus carpio and Salmo gairdneri acclimated under identical laboratory conditions. Anaesthesia with MS222 resulted in a 'chemical stress' in all fish, as was evident from changes in the haematological profiles of the animals. Such species specific variations in the haematology persisted throughout the whole experiment protocol which employed different concentrations of the anaesthetic. The use of neutralized MS222, whereby aquarium water quality remained unchanged, improved the haematological profile. Possible reasons for the interspecies differences observed are discussed. (Deal-EIS)
W80-03990

EFFECTS OF NONSETTLEABLE BIOSOLIDS ON STREAM ORGANISMS,
Academy of Natural Sciences, Philadelphia, PA.
S. L. Friant, R. Patrick, and L. A. Lyons.
Journal of the Water Pollution Control Federation, Vol 52, p 351-363, 1980. 5 Fig, 10 Tab, 11 Ref.

Descriptors: *Secondary treatment, *Sewage effluents, *Toxicity, *Aquatic life, *Streams, Suspended solids, Waste treatment, Domestic wastes, Industrial wastes, Bacteria, Chlorophyta, Protozoa, Scenedesmus, Susquehanna River, Pulp wastes, Pulp and paper industry.

Experiments were conducted to determine whether organic, nonsettleable solids that result from secondary treatment of domestic and industrial wastes are deleterious to aquatic life in a stream. These solids are very slowly settleable; in laboratory experiments at 10 mg/l they did not alter by 10% the light penetration at wavelengths of 600 and 700 nm. They did not seem to increase the bacterial count in a stream that has the characteristics of the Susquehanna River water. There was no definite stimulatory effect on the green alga, Scenedesmus abundans. Bacteria and particulates composing the nonsettleable solids were a satisfactory food source for Paramecium aurelia. (Deal-EIS)
W80-03991

THE EFFECT OF DISSOLVED COPPER ON THE INCREASE IN LENGTH OF FOUR SPECIES OF INTERTIDAL FUCOID ALGAE,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5A.
W80-03992

EFFECT OF SALINITY OF THE WATER ON MACROPHYTES IN LAKES OF THE SOUTH URAL ZONE,
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.
I. A. Petrova.
Hydrobiological Journal, Vol 14, No 5, p 10-14, 1978. 4 Tab, 4 Ref.

Descriptors: *Salinity, *Toxicity, *Productivity, *Lakes, Water chemistry, Aquatic plants, Biomass, Biological communities, Aquatic algae, Rooted aquatic plants, USSR, Southern Urals, *Macrophytes.

The effect of water salinity on the species composition and the productivity of macrophytes in lakes is confirmed. As the salinity of lake water increases, the variety of macrophyte species decreases and freshwater forms are replaced by saltwater ones. The biomass of the most widely distributed Arundineae and Potamogeton pectinatus communities also decreases. (Deal-EIS)
W80-03993

MECHANISMS OF REGULATION OF THE ACID-BASE BALANCE IN FISH AS THEY ADAPT TO CARBON DIOXIDE LEVELS IN AN AQUEOUS ENVIRONMENT,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-03994

CHANGES IN BIOCHEMISTRY OF SOME AQUATIC ORGANISMS OF THE BARENTS SEA COAST IN EXPERIMENTAL OIL INTOXICATION,
Institute of the Biology of Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5A.
W80-03996

KINETICS OF ACCUMULATION OF SOME RADIONUCLIDES BY MARINE BACTERIA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5A.
W80-03997

DDT-INDUCED CHANGES IN THE ACTIVITY OF THE PHOTOSYNTHETIC SYSTEM OF AQUATIC PLANTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
T. I. Shokod'ko, A. I. Merezhko, and M. V. Malinovskaya.
Hydrobiological Journal, Vol 14, No 5, p 75-78, 1978. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *DDT, *Toxicity, *Photosynthesis, *Aquatic plants, Pesticide toxicity, Mode of action, Chlorinated hydrocarbon pesticides, Inhibition, Chlorophyll, Metabolism, Plant physiology, *Pondweed, *Potamogeton, *Hornwort, *Ceratophyllum.

A study of the effects of DDT on aquatic plants (e.g., the pondweed Potamogeton perfoliatus L. and the hornwort Ceratophyllum demersum L.) showed that even the smallest concentrations of this pesticide inhibited photosynthesis. With increasing DDT concentration, the contents of chlorophylls and carotenoids decreased (though to a lesser extent than the rate of light-induced ferricyanide reduction), as did oxygen evolution. The processes associated with C02 assimilation were inhibited. In plants with a high chlorophyll content (pondweed), the photochemical activity (PCA) per unit weight of this pigment is lower than in species with low chlorophyll content (hornwort). (Deal-EIS)
W80-03998

ACUTE TOXICITY OF SOME EXPERIMENTAL ROAD SURFACING COMPOUNDS TO DAPHNIA PULEX,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
G. C. Bailey.
Bulletin of Environmental Contamination and Toxicology, Vol 21, p 618-623, 1979. 4 Tab, 4 Ref.

Descriptors: *Toxicity, *Daphnia, *Highway icing, *Deicers, Paving, Road construction, Melting, Snow removal, Bioassay, Asphalt, Salts, Chemical analysis, Mortality, Leachate, Chemical properties.

The many damages caused by the use of salt for road deicing have prompted the development of several experimental chemical compounds. These compounds are potential contaminants of surface waters through runoff from prepared road surfaces. To assess the potential environmental hazard of these compounds bioassays were performed using Daphnia pulex. The 06-H LC50 was determined for eight experimental compounds. (Deal-EIS)
W80-04003

LONG-TERM EFFECTS OF WATER-SOLUBLE FRACTIONS OF KUWAIT CRUDE OIL ON THE LARVAL AND JUVENILE DEVELOPMENT OF THE MUD CRAB EURYPANOPEUS DEPRESSUS,
Delaware Univ., Lewes. Marine Studies Complex.
For primary bibliographic entry see Field 5A.
W80-04004

SOME BIOCHEMICAL CONSTITUENTS OF STAGE I AND II NAUPLII OF BALANUS BALANOIDES (L.) AND THE EFFECT OF ANOXIA ON STAGE I,
Dunstaffnage Marine Research Lab., Oban (Scotland).
Y. Achituv, J. Blackstock, M. Barnes, and H. Barnes.
Journal of Experimental Marine Biology, and Ecology, Vol 42, p 1-12, 1980. 5 Tab, 34 Ref.

Descriptors: *Enzymes, *Metabolism, *Mollusks, *Anaerobic conditions, Dissolved oxygen, Oxygen requirements, Proteins, Lipids, Biochemistry, Aerobic conditions, Growth stages, Animal physiology, Energy conversion, *Barnacles, *Tissue analysis.

Some aspects of the energy-yielding metabolism of early larval stages of Balanus balanoides have been investigated by comparison of the concentrations of some biochemical constituents and certain enzyme activities in newly hatched stage I nauplii, stage I nauplii maintained for 4 h under anaerobic conditions, and stage II nauplii obtained after allowing stage I to remain in sea water in aerobic conditions for 24 h. The mean dry weight per nauplius was 1.02 microg for stage I and 0.78 microg for stage II under aerobic conditions and it is thought that the main contribution to this weight loss is from protein (and some lipid) metabolized in order to maintain the vigorous swimming of the non-feeding stage I nauplius. Carbohydrate and free amino-acid concentrations and the activity of malate dehydrogenase, lactate dehydrogenase, and fructose-1,6-diphosphate aldolase were similar in stage I and stage II. Protein, and to a lesser extent lipid, remain the major substrates used under anaerobic conditions but the decreases in these could not be accounted for by increases in metabolic intermediate compounds. A small increase in lactate and succinate may possibly account for the small amount of carbohydrate utilized under anaerobic conditions. The results are discussed in terms of current knowledge of the metabolism of invertebrates with particular reference to the effect of anaerobiosis. (Deal-EIS)
W80-04005

SURVIVAL OF JUVENILE SPOT (LEIOSTOMUS XANTHURUS) EXPOSED TO BROMOCHLORINATED AND CHLORINATED SEWAGE IN ESTUARINE WATERS,
Virginia Inst. of Marine Sciences, Gloucester Point.
For primary bibliographic entry see Field 5A.
W80-04008

ON THE RESISTANCE OF ISOLATED BIVALVE GILL PIECES TO OXYGEN DEFICIENCY AND HYDROGEN SULPHIDE,
Sao Paulo Univ. (Brazil). Dept. de Fisiologia Geral.
K. Hiroki.
Boletim de Fisiologia Animal, Vol 1, p 9-20, 1977. 3 Fig, 4 Tab, 19 Ref.

Descriptors: *Lethal limit, *Oxygen requirements, *Animal physiology, *Mollusks, *Tissue analysis, *Anomalocardia, *Iphigenia, *Perna, *Gills, *Brazil, Hydrogen sulfide, Toxicity, Water chemistry, Animal metabolism, Sea water, Chemical analysis, Habitats, Intertidal areas, Littoral.

The lethal limits (LT50) of isolated gill pieces of three bivalve species commonly found in the Brazilian coastal waters, both in low oxygen concentration and in simultaneous presence of hydrogen sulfide, were determined. Anomalocardia brasiliana and Iphigenia brasiliensis inhabit the intertidal zone and Perna perna the sublittoral fringe. Anomalocardia brasiliana was the most resistant species in both experimental conditions, followed by Perna perna and Iphigenia brasiliensis. The survival times were longer in oxygen deficient sea water than in the presence of hydrogen sulphide. Correlation between the LT50 values and the species habitats was observed. (Deal-EIS)
W80-04009

INDICATION OF ANTHROPOGENIC EUTROFICATION IN LAKE LADOGA,
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.
I. I. Nikolayev, and N. A. Petrova.
Hydrobiological Journal, Vol 14, No 5, p 1-6, 1978. 5 Tab, 23 Ref.

Descriptors: *Lakes, *Trophic level, *Phytoplankton, *Zooplankton, Dominant organisms, Seasonal, Mesotrophy, Eutrophication, Productivity, Crustaceans, Rotifers, Protozoa, Biological communities, Aquatic populations, Biomass, USSR, Lake Ladoga.

A comparison of data on the present planktonic community in Lake Ladoga with data from studies done at the beginning of the century and in the 1960s shows that although the species distribution in phyto- and zooplankton communities has in general remained stable, there has been a change in the dominant species and an increase in algal concentrations. During the spring diatom bloom in the southern and eastern parts of the lake, which are the most productive, the abundance and biomass of phytoplankton now exceed by 1.5 to 5 times the maximum deviations from the mean recorded in 1960 to 1962. Zooplankton (crustaceans, rotifers and protozoans) density in the top 5 m layer of water resembles that in mesotrophic lakes. Based on chlorophyll content of plankton, Lake Ladoga is now mesotrophic. (Deal-EIS)
W80-04010

ELEMENTAL CONTENT OF AQUATIC ORGANISMS INHABITING A POND CONTAMINATED WITH COAL FLY ASH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Office of Occupational Health and Safety.
For primary bibliographic entry see Field 5B.
W80-04011

EXTENT AND NATURE OF THERMAL STRESS ON COPEPOD POPULATIONS,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159924, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of Maryland, College Park, Technical Report No 56, (1979). 20 p, 2 Fig, 5 Tab, 5 Ref. OWRT A-046-MD(1), 14-34-0001-8022.

Descriptors: *Copepods, *Comparative productivity, *Temperature variations, *Temperature, Adaptation, Genetic variance, Acclimation, Egg production, Eurytemora affinis.

Among populations of the copepod Eurytemora affinis grown in three constant (10, 15, 23C) and three variable environments, more genetic adaptation occurred in a temperature regime cycling at 1 degree per day than in a regime cycling at 1 degree per week or in a very gradually increasing regime. Egg production (measured in five regimes) was lowest at 23C, highest at 10 and 15C and intermediate in the two cycling regimes. Potential for further genetic and physiological adaptation remained in all regimes suggesting that lowered reproduction at higher temperatures may retard extreme selection for temperature tolerance.
W80-04014

IMMUNE RESPONSE TO BACTERIAL IMMUNIZATION OF CHANNEL CATFISH MAINTAINED IN A RECIRCULATING WATER-REUSE SYSTEM,
Memphis State Univ., TN.
D. D. Ourth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160393, Price codes: A03 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Knoxville, Research Report No 73, December 1979. 22 p, 5 Fig, 2 Tab, 22 Ref. OWRT A-056-TENN(1), 14-34-0001-9045.

Descriptors: *Channel catfish, *Commercial fish, Fish farming, Agriculture, Recirculated water, Water reuse, *Aquatic bacteria, *Bacterial immunization, Analytical techniques.

Intraperitoneal immunization of channel catfish, Ictalurus punctatus, with the Gram-negative bacterium Salmonella paratyphi in Freund's complete adjuvant produced persistant serum agglutinating antibody titers of hundreds of thousands during an immune response of about one year. Bactericidal activity of two high-titered sera averaged 30% and 20%. Post-immunization bactericidal activity varied little and remained within 10% of pre-immunization activity. The enzyme lysozyme, active against Gram-positive bacteria, was present at 1.8 ug/ml serum or 34 ng lysozyme/mg protein. Channel catfish serum can therefore provide protection against both Gram-positive and Gram-negative bacteria that the catfish may come in contact with in its aquatic environment. Channel catfish (Ictalurus punctatus) skin mucus also demonstrated an immunological function. Agglutinating antibody (titer of 1:80) and a bactericidal response to Salmonella paratyphi were found in the mucus after intraperitoneal injection of bacteria. By immunodiffusion in gel, the catfish skin mucus gave a precipitin line of identity with catfish 14S serum macroglobulin against rabbit anticatfish 14S serum indicating the presence of secretory IgM in the mucus. Parenteral immunization (intraperitoneally) can thus yield specific IgM antibody in the mucus. Lysozyme at a concentration of 183 ng/ml was demonstrated in the mucus. 8% of skin mucus cells from Wrigh-stained smears were lymphocytes which are immunocompetent cells in fish.
W80-04016

NUTRIENTS LIMITING PHYTOPLANKTON PRODUCTION IN ICE-COVERED LAKE ST. CLAIR,
Windsor Univ. (Ontario). Dept. of Biology.
D. G. Wallen.
Journal of Great Lakes Research, Vol 5, No 2, p 91-98, 1979. 4 Fig, 2 Tab, 38 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Limiting factors, *Lakes, Sampling, Laboratory tests, Silica, Phosphates, Phosphorus, Nitrogen, Trace elements, Water pollution, Biomass, Ice cover, Winter, Limnology, Biology, Water pollution effects, *Lake St. Clair.

Nutrient enrichment experiments on ice-bound phytoplankton populations at three stations in Lake St. Clair, of the St. Lawrence Great Lakes system, showed that silica was the primary nutrient limiting phytoplankton growth and photosynthesis in the Thames River plume in mid winter. The addition of silica at concentrations of 150 micrograms/liter or greater relieved this limitation. Phosphate appeared to be a secondary limiting factor. Stations 1 and 2 below river outlets, draining rural and urban areas, showed variable results

Trace metal limitation was observed at station 1 on February 20, trace metal and vitamin limitation at station 2 in March. Possible limitation by phosphate was occasionally evidenced. (Sims-ISWS)
W80-04051

SHELF-SEDIMENT DYNAMICS AND SOLID-WASTE DISPOSAL,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
D. S. Gorsline.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 9-16, 1979. 30 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Dredging, *Waste disposal, *Water pollution effects, Continental shelf, Solid wastes, Sediments, Clays, Dispersion, *Outer Continental Shelf, *Ocean dumping, Dredge materials, Dump sites.

Dredged material is commonly natural material that has been deposited under riverine, estuarine or deltaic conditions. It includes natural terrigenous and biogenic detritus, organic matter and debris and adsorbed metal ions and organic compounds of natural or man-generated origins. Its dispersion is identical to dispersion for naturally contributed sedimentary materials and the particles will follow the same paths. Other than the effect of overwhelming mass dumped in a locality, the major problem environmentally is the smaller fraction of dredge spoil that contains pollutants. Since a large proportion of these contaminants is adsorbed on the clay fraction which moves as suspended load, the major environmental impact is the disposal of the fine fraction. Most harbors are located in estuaries or the lower reaches of major rivers, and so the most complex problems of control of spoil disposal are due to the inherent characteristics of estuarine circulation and particularly to the fact that estuaries are sediment traps. They typically draw from both river input and from adjacent shelves and thus the problem of finding suitable dump sites outside a given system may be economically and technically difficult. More information is needed about such problems as the rates of benthic boundary layer processes, the paths of suspended sediment transport over shelves and the net contributions of estuaries to shelves in normal and storm periods. Deep water sites should be avoided until more is known about the biology of those environments. (Sinha-OEIS)
W80-04063

WASTE DISPOSAL AND DREDGING ACTIVITIES: THE GEOLOGICAL PERSPECTIVE,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross, and H. D. Palmer.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 1-7, 1979. 36 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Dredging, *Waste disposal, *Water pollution effects, Sediments, Benthos, Environmental effects, Resources development, *Outer Continental Shelf, Ocean dumping, Dredged material, Geological effects.

Dredging and disposal of dredged materials are among the most important activities affecting estuaries and the coastal ocean in the United States. Effects of dredged material disposal on continental shelves can be appreciated only when it is realized that, except for a few major rivers, nearly all sediment transported by rivers is trapped and normally deposited in estuaries, bays, and harbors. Consequently, dredging operations are not only supplying a large quantity of waste solids but are moving them to the continental shelf where little other sediment is being deposited to dilute or bury the wastes. In areas where large volumes of materials have been dumped for an extended period, bottom-dwelling communities have been transformed substantially. The abundance of number of different types of marine organisms was substantially reduced in the waste disposal areas of the New York Bight. The presence of human pathogens in the sewage-drived constituents in many dredged materials makes ocean bottoms used for waste disposal unsuitable for production of shellfish for human consumption and less attractive for recreational fishing. Disposal of waste solids in continental shelf areas can alter bottom topography and sediment composition and texture. Therefore it is clear that dredging and disposal operations cannot be ignored and it is essential that the multiple interactions between natural agents and processes and the by-products of 'civilization' be understood. (Sinha-OEIS)
W80-04064

STABILITY OF DREDGED MATERIAL DEPOSITED SEAWARD OF THE COLUMBIA RIVER MOUTH,
Washington Univ., Seattle. Dept. of Oceanography.
R. W. Sternberg, J. S. Creager, J. Johnson, and W. Glassley.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 17-49, 1979. 13 Fig, 8 Tab, 23 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Solid wastes, *Water pollution effects, *Sediments, Sediment transport, Oregon, Washington, Environmental effects, *Outer Continental Shelf, Columbia River, Dredged material, Ocean dumping.

A two-part study was conducted in a region seaward of the Columbia River where disposal of large quantities of dredged material has occurred over the last several decades. The first part included repeated bathymetric surveys and sampling for distribution and seasonal variations of sediment texture and mineral composition throughout the study area, and especially at designated disposal sites. Near-bottom hydraulic conditions (waves, tides, currents, turbidity) were also measured at several sites and during all seasons. The second part was related to an experiment in which 459,000 cubic meters of material dredged from the Columbia River estuary were discharged at a designated site, which was monitored before, during, and after disposal. Sedimentological aspects of the study were to identify and map all deposits of dredged material and to recognize seasonal and long-term changes. The objectives of the hydraulic aspects were to document ambient near-bottom conditions, and their effect on the deposit at the experimental site. Deposits of dredge material can be identified relative to the surrounding sediments, because they tend to maintain their identity for many years. Sedimentological evidence suggests that the deposits disperse northward at approximately 0.5 km per year. At the experimental disposal site the volume of the bottom deposit was 61% of the total material dumped. Calculations of bedload transport rates, based on seasonal measurements of bottom currents, suggest that 635 cubic meters of material (0.2% of the total deposit) spread northward from the site at about 0.4 km per year. This is similar to the rates determined by analysis of sediment mineralogy. (Sinha-OEIS)
W80-04065

GEOLOGIC EFFECTS OF OCEAN DUMPING ON THE NEW YORK BIGHT INNER SHELF,
Corps of Engineers, Fort Belvoir, VA.
S. J. Williams.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 51-72, 1979. 10 Fig, 2 Tab, 17 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Water pollution effects, *Solid wastes, Sediment transport, Geology, Sewage disposal, Dispersion, Environmental effects, New York, Sludge, *Outer Continental Shelf, New York Bight, Ocean dumping.

High resolution seismic reflection records, sediment cores and deep borings, and comparison of bathymetric charts from 1845 to 1973 provide evidence that ocean dumping of assorted solid materials has significantly filled parts of the Hudson shelf channel, and is an important geologic process. Ocean disposal of natural and man-made wastes was official initiated seaward of New York Harbor in 1888 to relieve health problems, congestion and accelerated shoaling of navigation channels long associated with uncontrolled disposal within the city and adjacent waterways. Records show that about 850 million cubic meters of liquid and solid wastes have been dumped in the past 85 years. This has resulted in creation of several mounds with relief of about 15 m covering an area of about 9 thousand hectares. The calculated volume of anthropogenic solids filling the Hudson channel is 318 million cubic meters. Much of the material is similar in character to indigenous sediment. The results indicate most materials except sewage sludge are fairly stable and remain in the original dump sites. In spite of large volumes of sludge dumped at the same site since 1924, no evidence of significant accumulation on the seafloor has been found. (Sinha-OEIS)
W80-04066

MUD DEPOSITS NEAR THE NEW YORK BIGHT DUMPSITES: ORIGIN AND BEHAVIOR,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
G. L. Freeland, D. J. P. Swift, and R. A. Young.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 73-95, 1979. 13 Fig, 1 Tab, 40 Ref, Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Water pollution effects, *Sediments, *Sediment transport, Sewage disposal, Environmental effects, New York, Mud, *Outer Continental Shelf, New York Bight, Ocean dumping, Dredged material, Dumpsites, Sewage sludge.

A detailed investigation of the floor of the New York Bight apex reveals that muddy sediment occurs in the Christiaensen Basin, in the fringing lagoons and marshes near the mouths of tidal inlets, and in ephemeral patches on the Long Island shoreface, where mud settles into the troughs of sandwave-like bedforms. The appearance and disappearance of these nearshore mud patches has led to an erroneous concept of a sewage-sludge 'front' advancing toward the Long Island beaches from the sewage-sludge dumpsite. While Bight apex mud deposits do contain sewage sludge, this contamination is usually not apparent in gross physical properties or composition; sophisticated chemical techniques are required to detect the contamination. Fine-grained deposits near the New York Bight sewage-sludge dumpsite are primarily of natural origin and should, therefore, be called mud, not sludge. Fine-grained sediment at the dredge-spoil dumpsite is also mostly natural sediment, but it is anthropogenic in that it is dredged harbor and estuary sediment. The impact of sewage-sludge dumping in the New York Bight apex depends to a large extent on the pathways and rates of natural sediment transport system. Such limited information as is available suggests that the rate of sewage-sludge dispersal is high relative to the rate of input. The model leads to the inference that sewage sludge is rapidly diluted in the Bight apex by natural sediment, and the more stable sewage-sludge components are widely dispersed through the natural mud deposits of the New York Bight system. (Sinha-OEIS)
W80-04068

CONTAINMENT OF PARTICULATE WASTES AT OPEN-WATER DISPOSAL SITES,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
H. J. Bokuniewicz, and R. B. Gordon.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal, p 109-129, 1979. 10 Fig, 20 Ref, Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Sediments, *Water pollution effects, Sedimentation, Environmental effects, New York, *Outer Continental Shelf, Dredged material, Ocean dumping, New York Bight, Sedimentary regimes, Biological effects.

The degree of retention of particulate silt-clay size waste at open-water disposal sites depends primarily on the sedimentary regime at the site and the height of the waste deposit. In marine localities the tidal stream will disperse waste placed in a deposit rising above natural topographic features of the bottom unless its surface is armored by erosion-resistant material or the natural sedimentation rate exceeds a critical value that depends on pile height. These factors are evaluated for dredged material disposal sites in Long Island Sound. Silt-clay is found to be dispersed at the Cornfield Point site, where the natural sedimentation rate is zero, but retained at the New Haven site, where natural sedimentation is 0.8 kgm/sq m yr). At the latter site 1.2 x 1,000,000 cu m of dredged material was placed in a conical mound 8 m high. Self-consolidation occurred over several weeks and caused an outward advection velocity of interstitial water as great as 0.00005 cm/sec. The top of the waste pile penetrates the wave-affected zone but, because it is armored with sand and clods of cohesive silt, it is not dispersed. The lower part of the waste pile is unarmored. Tidal resuspension of the neighboring muddy bottom and the waste deposit occurs every tidal cycle and is increased by as much as a factor of ten during severe storms. A layer of wastes less than 1 cm thick is intermixed with sediments from the neighboring sea floor within a few weeks after deposition is completed; subsequent entrance of wastes into the water column is due to biological mixing in the top 10 cm of the waste deposit. The results show that permanent waste deposits may be constructed in coastal localities with favorable natural sedimentary regimes provided close control over the deposition process is attained. (Sinha-OEIS)
W80-04069

DREDGING AND DISPOSAL IN CHESAPEAKE BAY, 1975-2025,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross, and W. B. Cronin.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 131-145, 1979. 3 Fig, 7 Tab, 26 Ref, Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Dredging, *Water pollution effects, Sediment transport, Environmental effects, Resources development, *Outer Continental Shelf, Chesapeake Bay, Ocean dumping, Dredged material, Biological effects.

In Chesapeake Bay frequent dredging is required in three locations: Bay entrance, harbors, and the turbidity maxima at the fresh-/salt-water interfaces. Between 1975 and 2025, 560 x 1,000,000 cu m are scheduled to be dredged to maintain existing channels and to deepen them to accommodate larger vessels. One third of the dredging is associated with new construction projects; two thirds comes from maintenance dredging. Approximately half the maintenance dredging will be done in port areas where much of the dredged material may be mixed with industrial wastes and sewage discharged. Sources of deposits in channels and port facilities in Chesapeake Bay are poorly understood. Although river sediment discharge to Chesapeake Bay is the main source, smaller but unknown amounts of sediment are contributed by sewage treatment plants, urban runoff, industrial processes, and shoreline erosion. Available data suggest mostly localized and transitory biological effects for those disposal operations involving unpolluted materials that do not alter the physical or chemical character of the bottom. Long-term effects of dredged material disposal in the Bay such as altered current regimes or sediment transport can not be predicted with confidence. Because of shortages of wetland disposal sites, opposition to open-water disposal, and high costs of diked disposal areas, new disposal sites and techniques will likely be needed in the next 50 years to handle the disposal of materials from needed dredging in Chesapeake Bay. Dredging and disposal of dredged materials will continue to be major geological processes in Chesapeake Bay. (Sinha-OEIS)
W80-04070

THE PROBLEM OF MISPLACED SEDIMENT,
Virginia Inst. of Marine Sciences, Gloucester Point.
M. M. Nichols.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 147-161, 1979. 9 Fig, 19 Ref, Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Dredging, *Water pollution effects, *Estuaries, Environmental effects, Sediment transport, Resources development, *Outer Continental Shelf, Ocean dumping, Dredged material, Dredge disposal.

Disposal of estuarine dredged material is a major depositional process with important sedimentologic and hydraulic consequences. Large-scale dredging in U.S. East Coast estuaries has cut channels far below natural equilibrium depths and induced rapid sediment accumulation. In turn, the increased frequency of dredging has created a massive disposal problem and a need for ocean dumping. An estuary channel attains maximum stability by adjusting its bed geometry and hydraulic regime. When a channel is deepened, tidal currents are reduced and sediment deposition accelerates. Deepening causes more salty water to penetrate landward and shifts the zone of maximum shoaling upstream. Landward density currents accelerate the potential for return of dredged material from seaward reaches, while higher stratification enhances the potential for entrapment. Therefore, dredging is partly self-perpetuating. Long-continued open water disposal along channel shoulders of the Upper James Estuary, Virginia, has built up mounds close to the surface where they are subject to wave erosion and current scour. Mounds of misplaced sediment with slopes greater than 6 degrees allow return of sediment to the channel and they restrict tidal flow. By reducing the cross sectional area, they surpress the tide range and tidal discharge in landward reaches. Consequently, dispersion of pollutants is reduced and accumulation of fine-grained sediment is promoted. As a consequence of dredging and disposal, many estuaries are loosing their capacity to absorb more misplaced sediment. (Sinha-OEIS)
W80-04071

NO WASTE DISPOSAL SITES ON THE CONTINENTAL SHELF OFF THE MIDDLE ATLANTIC STATES: OBSERVATIONS MADE FROM SUBMERSIBLES,
Geological Survey, Woods Hole, MA.
D. W. Folger, H. D. Palmer, and R. A. Slater.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 163-184, 1979. 8 Fig, 5 Tab, 26 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Water pollution effects, *Sediments, Sewage sludge, Benthos, Environmental effects, Resources development, *Outer Continental Shelf, Mid-Atlantic Bight, Ocean dumping, Acid wastes.

Nineteen dives were conducted in August 1974 and July 1975 to survey the Philadelphia sewage and DuPont acid dumpsites about 65 km southeast of the mouth of the Delaware Bay. Though 1974 dives in the sewage dumpsite were carried out the day after 2 million gallons of sewage was released, little evidence of sewage remained in the water column or on the bottom within the area of the dumpsite. Oscillatory wave motion, tidal currents, and benthic organisms apparently were the main mechanisms redistributing sediment on the bottom during the period of the dives. In 1974, at the center of the acid waste site, where a 1-million-gallon release of acid had just taken place, visibility in the water column 6-9 m deep was reduced to zero. Below this opaque layer, suspended matter was composed mainly of large reddish-yellow flocks 1-3 cm long. The visibility reduction and the flocks were apparently due to precipitates from the acid waste that were concentrated at the top of the thermocline. During dives conducted in 1974, bottom samples were collected by both the mother ship and the submersible. At five sites, in both dumpsites, gravel (including shell fragments) averaged 6.1%; sand 88%; and silt plus clay, 2.1% of the sediment. Both coarsest and finest materials were accumulating in ripple troughs. Fe, Ti, and Cr in sediments were all higher at the acid site than in surrounding areas. Thus, sewage sludge apparently was being oxidized, eaten, or transported away from the dumpsite and accumulating elsewhere, whereas some acid waste was accumulating on the bottom in the disposal area. (Sinha-OEIS)
W80-04072

MATHEMATICAL MODELING PREDICTIONS OF THE GEOLOGICAL EFFECTS OF SEWAGE SLUDGE DUMPING ON THE CONTINENTAL SHELF,
Raytheon Co., Portsmouth, RI. Environmental Research Lab.
D. O. Cook.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 185-203, 1979. 11 Fig, 16 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Sewage sludge, *Water pollution effects, *Mathematical models, Benthos, Environmental effects, Resources development, Waste disposal, *Outer Continental Shelf, Ocean dumping, Geological effects, Mid-Atlantic Bight.

A far-field (beyond the initial mixing zone) water quality math model has been adapted to predict geological implications of ocean dumping. The example simulated is ongoing discharge of digested sewage sludge by the City of Philadelphia at a disposal site located at mid-shelf in the Middle Atlantic Bight. After calibration of the model using hydrographic field data, predictions were made of the horizontal distributions of suspended solids and deposition following an individual dumping incident. The distributions shift south-southwest of the discharge line in response to non-tidal currents and disperse over a larger area with time. The predictions are highly dependent upon assumed settling characteristics of the sludge. The hydrodynamic simulation of the study area appears to be reasonably accurate. The geological predictions, in particular those for deposition, represent a first order estimate because of uncertainties in sludge solid settling behavior and pre/post depositional sludge fate. Regarding this fate, the effects of sludge recycling by zooplankton in the water column and detritus feeders on the sea floor are unknown. Also, the presence of physical structures in bottom photographs suggests that settled sludge solids would be subject to periodic resuspension. Until these uncertainties are resolved and quantified, the primary use of predicted depositional patterns is to indicate those areas of the sea floor where the benthic community may potentially be affected by sludge disposal. (Sinha-OEIS)
W80-04073

DISTRIBUTION OF SUSPENDED PARTICULATE MATTER NEAR SEWAGE OUTFALLS IN SANTA MONICA BAY, CALIFORNIA,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
R. L. Kolpack.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 205-239, 1979. 25 Fig, 37 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Sewage sludge, *Sediment transport, Suspended solids, Sediment-water interfaces, Outfall sewers, Water pollution effects, Environmental effects, California, Resources development, *Outer Continental Shelf, Ocean dumping, Santa Monica Bay.

Distribution and transport paths of sewage particles within the water column on the Santa Monica

Shelf were studied with more than 500 light-transmission profiles made on 8 cruises between September 1970 and November 1972. Additional measurements of temperature, salinity and bottom currents were used to interpret the distribution of suspended matter in the water column. No significant accumulation of particulate material around the discharge sites has been detected. The sewage plume in Santa Monica Bay rises rapidly from an initial discharge depth of about 60 meters to about 20 meters below the water surface. On occasion the sewage effluent can be detected at the water surface. Wave action in the water column tends to disperse the sewage plume over a large part of the Santa Monica Shelf. The dominant direction of initial transport during most of the year is toward the shoreline southeast of the discharge site. Subsequently, at several reasonably consistent locations within the bay the net transport of the sewage material, as well as material derived from nearshore mixing, is directed toward the west and transported offshore in well-defined zones which are approximately normal to the coastline. The amount of suspended material transported to the offshore area via Santa Monica and Redondo canyons appears to be rather negligible during normal conditions. On the other hand, a significant portion of the suspended material in Santa Monica Bay is transported within the near-surface water column toward the offshore basins. This pattern of particle transport also takes place at the water surface and at the sediment-water interface, although there is somewhat more variation near these surfaces. (Sinha-OEIS)
W80-04074

DREDGED MATERIAL, OCEAN DISPOSAL, AND THE REGULATORY MAZE,
Smith (David D.) and Associates, San Diego, CA.
D. D. Smith.
In: 'Ocean Dumping and Marine Pollution--Geological Aspects of Waste Disposal,' p 241-262, 1979. 2 Fig, 1 Tab, 29 Ref. Palmer, H.D. and Gross, M.G. (Eds), Dowden, Hutchinson and Ross, Inc, Stroudsburg, Pa.

Descriptors: *Waste disposal, *Dredging, *Regulations, Water pollution, Environmental effects, Resources development, *Outer Continental Shelf, *Ocean dumping, Dredged material, Environmental impact statements.

Dredged material disposed of at sea each year totals about 50 to 75 x 1,000,000 cu m, which is roughly 15 to 20% of the total sediment dredged in the U.S. annually. These volumes are discharged at some 125 designated ocean disposal sites, of which about 60% are located within the three mile limit. Disposal of dredged material requires a permit issued by the Corps of Engineers in accordance with Environmental Protection Agency regulations and criteria. Obtaining this permit requires maneuvering through a complex procedural network (i.e. the regulatory maze) comprised in part by the numerous and varied criteria that govern the review and processing of the permit application. The regulations governing ocean disposal also presecribe additional sets of criteria for evaluating (1) the dredged material to be disposed of, (2) the site proposed for disposal use, and (3) the environmental effects of the proposed disposal activity. Thus, literally dozens of criteria must be considered by the Corps in reaching a decision as to whether or not a permit for ocean disposal should be issued. Unfortunately, the governing regulations contain no recommended framework or standard methodology within which these many croteria can be applied--a major omission that requires resolution. Until such a framework or methodology is established, the decisions reached using the criteria must be recognized as highly subjective and potentially vulnerable to litigation. (Sinha-OEIS)
W80-04075

EASTERN GULF OF MEXICO MARINE HABITAT STUDY. VOLUME I.
Woodward-Clyde Consultants, Orange, CA.
For primary bibliographic entry see Field 5B.
W80-04076

EASTERN GULF OF MEXICO MARINE HABITAT STUDY. VOLUME II: MAPS AND CROSS SECTIONS.
Woodward-Clyde Consultants, Orange, CA.
For primary bibliographic entry see Field 5B.
W80-04077

INVESTIGATIONS OF PHYSICAL PROCESS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. A. Galt.
In: 'The AMOCO CADIZ Oil Spill. A Preliminary Scientific Report,' p 7-20, April 1978. 3 Fig, 11 Ref, 11 Photos, NOAA/EPA Special Report.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, *Tidal effects, *Winds, Coasts, Environmental effects, Beaches, Intertidal areas, Currents(Water), Shores, *Outer Continental Shelf, Amoco Cadiz, Nearshore processes, Environmental impact, France.

The Amoco Cadiz disaster presented a unique opportunity to study oil spills in the marine environment. The massive amounts of oil discharged, and its position close to a lee shore made this a particularly interesting spill to study. The spilled oil appeared in a variety of forms. These could be described in terms of four classes: mousse, sheen, light foam, and weathered mousse as small globs. Estimates were made of what was thought to be the dominant oceanographic or metorological processes affecting the movement and spreading of the oil. Winds were strong during much of the spill event and contributed to the oil movement both directly and indirectly. Direct wind forcing was through wind/wave/oil interactions, and indirect forcing was hypothesized to take place through a sea surface set-up along the coast and subsequent development of an alongshore current system. Both components of the wind forcing tended to move the oil eastward in a coastal band during the March periods of study. Tidal forcing was investigated and estimated to play an important role through convergences and divergences in the offshore area and through the beaching/tidal pumping sequence that took place along the coast. The orientation of the coastline and alongshore current system were seen to affect the oil distribution. The stranding of heavy oil concentrations appeared to occur only during ebbing tides and seemed condition on the intertidal beach face coming in direct contact with the oil. (Sinha-OEIS)
W80-04078

CHEMICAL COMPOSITION OF SELECTED ENVIRONMENTAL AND PETROLEUM SAMPLES FROM THE AMOCO CADIZ OIL SPILL,
National Oceanic and Atmospheric, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
J. A. Calder, J. Lake, and J. Laseter.
In: 'The AMOCO CADIZ Oil Spill. A Preliminary Scientific Report,' p 21-83, April 1978. 35 Fig, 10 Tab, 4 Photos, NOAA/EPA Special Report.

Descriptors: *Oil spills, *Water pollution, *Chemical analysis, Sampling, Environmental effects, Weathering, Biota, Resources development, *Outer Continental Shelf, France, Brittany.

The analyses described in this report represent initial chemical investigations by the University of New Orleans' Center for Bio-Organic Studies (UNO-CBS), the U.S. Environmental Protection Agency, Environmental Research Laboratory, Narragansett (EPA-ERLN), and the National Oceanic and Atmospheric Administration's National Analytical Facility NOAA-NAF), on the composition and fate of oil spilled along the Brittany coastline by the Amoco Cadiz. While many of the analyses are qualitative in nature, much quantitative information is presented. The information reported is useful in studying the nature and composition of the initial petroleum entering the environment and the transformation of this material as part of the weathering process. Selected samples were collected at different locations along the Brittany coastline. Samples included weathered oil samples floating on the water surface, samples of the mousse (water-in-oil emulsion) and oily froth, soils, sediments, water column samples, and biota samples such as sea grass, polychaetes, and periwinkles from the tidal zone. Medium Arabian crude oil was analyzed as a standard. (Sinha-OEIS)
W80-04079

INVESTIGATIONS OF BEACH PROCESSES,
South Carolina Univ. Columbia. Dept. of Geology.
E. R. Gundlach, and M. O. Hayes.
In: 'The AMOCO CADIZ Oil Spill. A Preliminary Scientific Report,' p 84-196, April 1978. 65 Fig, 24 Tab, 13 Ref, 21 Photos, NOAA/EPA Special Report.

Descriptors: *Oil spills, *Water pollution effects, *Geomorphology, *Sediments, Environmental effects, Coasts, Beaches, Cleaning, *Outer Continental Shelf, Beach processes, Interstitial water.

According to the best estimate, 64,000 tons of the Amoco Cadiz oil came ashore along 72 km of the shoreline of Brittany during the first few weeks of the spill. At the end of April, the total volume of oil onshore was reduced to 10,000 tons, but, by that time, 320 km of shoreline had been contaminated. Coastal processes and geomorphology played a major role in the dispersal and accumulation of the oil once it came onshore. Although the surfaces of the beaches and tidal flats at many places were free of oil, the interstitial ground water was contaminated. This may have been the cause of the extensive biological kills at certain areas. Unfortunately, the use of large pits and trenches as collection sites for the oil may increase the amount of ground water contamination. The use of bulldozers to plow heavily oiled gravel into the surf zone for cleansing by wave action is a sound practice, from a geological point of view because no sediment is removed from the beach. Removal of sediment from certain areas increased the rate of beach erosion. The unrestricted use of heavy machinery on the beach and low-tide terrace generally turned oil deeper into the sediments. Where possible, traffic should be limited to specified access routes. (Sinha-OEIS)
W80-04080

BIOLOGICAL OBSERVATIONS,
National Marine Fisheries Service, Beaufort, NC. Southeast Fisheries Center.
F. A. Cross, W. P. Davis, D. E. Hoss, and D. A. Wolfe.
In: 'The AMOCO CADIZ Oil Spill. A Preliminary Scientific Report,' p 197-228, April 1978. 3 Fig, 2 Tab, 25 Ref, 24 Photos, NOAA/EPA Special Report.

Descriptors: *Oil spills, *Water pollution effects, *Environmental effects, *Oil pollution, Intertidal areas, Biota, Algae, Aquatic life, Resources development, *Outer Continental Shelf, *Biological effects, Brittany, Sea grasses, Patella vulgata, Patella, Aspera, Crastoderma-Cardium edule, Arenicola marina, Venerupis aurea, Littorina.

The portion of the Brittany coast impacted by the oil spill consists of diverse ecological habitats and biological communities, including exposed sandy beaches, rocky headlands, protectec bays, estuaries, and marshes. Biological communities in all these habitats were subjected to stress by the oil. Impact of the oil on intertidal communities in general was quite severe. Macroalgae on exposed rocks tended to retain the oil long after it had been removed from bare rocks by wave action. In addition to potential adverse effects of the oil on the macroalgae, retention of oil by this material undoubtedly increased contact time between the oil and organisms living beneath the algae. More chronic effects may be occurring, however, as several preliminary bioassays on these plants indicate that the fertilization process filed to occur in exposed algae. Adverse effects from exposure to oil were noted on limpets (Patella vulgata and P. aspera) over most of the impacted coastline. Nearly complete mortality of limpets and periwinkles occurred in the rocky intertidal zone immediately inshore of the wreck. Live cockles (Cerastoderma-Cardium edule), in particular, were ob-

served on the surface in sandy environments all along the affected coast. The valves of many of these animals could be pulled apart easily, which indicated their weakened condition prior to death. The mortality of intertidal organisms, in general, did not occur as soon as mousse entered their environment but was observed over a period of two months following the wreck. (Sinha-OEIS)
W80-04081

OIL SPILL CLEANUP ACTIVITIES,
Texas A and M Univ., College Station.
R. W. Hann, Jr., L. Rice, M-C. Trujillo, and H. N. Young, Jr.
In: 'The AMOCO CADIZ Oil Spill. A Preliminary Scientific Report,' p 229-275, April 1978. 26 Fig, 3 Tab, 16 Photos. NOAA/EPA Special Report.

Descriptors: *Oil spills, *Water pollution effects, *Cleaning, Intertidal areas, Environmental effects, Aquatic life, Equipment, Operations, *Outer Continental Shelf, Brittany, AMOCO CADIZ.

The oil spill from the supertanker AMOCO Cadiz off the Brittany Coast of France overshadows by far any other oil spill into the marine environment. In terms of oil reaching the shore, it was on the order of four times the amount of the Torrey Canyon spill in the same general geographic area or the Metula spill in the Straits of Magellan. As a result, the spill and the subsequent activities to clean up the oil and mitigate damage provided a fascinating laboratory for those interested in institutional structure, planning, resource requirements, technology and training to deal with disasters of this magnitude. The physical properties, behavior, and movement of the oil and its ultimate deposition on the beaches is discussed in detail. The organizational structure established to deal with the spill and the strategy of control that appears to have been followed are presented and evaluated with regard to their utility in other spills. In addition the processes and unit operations used on the beaches are discussed. Estimates of the manpower and equipment used at different times throughout the spill are based on extensive reviews of newspaper reports and daily pollution reports issued by the Department of Equipment. The final section discusses what has been learned from this experience. (Sinha-OEIS)
W80-04082

IMPACT OF AN INTRODUCED FISH SPECIES (MORONE AMERICANA) ON THE FISHERIES RESOURCES OF NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Forestry, Fisheries and Wildlife.
E. J. Peters, and R. Ballinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158512, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Nebraska Technical Completion Report, March 1980, 13 p, 3 Fig, 2 Tab, 6 Ref. OWRT A-051-NEB (1), 14-34-0001-9029.

Descriptors: *White perch, *Fish establishment, *Saline lakes, *Nebraska, *Environmental effects, Fish populations, Fish physiology, Fish stocking, Number fish per acre, *Morone americana.

During the mid-1960's white perch (Morone americana) were evaluated as a possible species to be stocked in several saline lakes of the Sandhills of Nebraska. This possibility was abandoned after it was found that populations did not reach sizes suitable for fishing. White perch were removed and reservoirs restocked with more desirable species; however, a remnant population was discovered in Salt Creek. The objectives of this study were to: (1) document the extent of the white perch population in the Salt Creek drainage; and (2) study the dynamics of the Buckley 3F Reservoir population and determine its rate of spread downstream. Sections of creek downstream from Buckley 3F reservoir were seined and electrofished during 1978 and 1979. The population of white perch in Buckley Creek 3F Reservoir was sampled irregularly throughout 1978 and 1979 in order to determine population density, growth rate, spanwing time, mortality rate and food habits. To date no evidence of white perch has been found in the Little Blue River drainage outside of Buckley Creek 3F Reservoir. This includes sampling Buckley Creek immediately downstream from the reservoir. The final best estimate of white perch in Buckley Creek 3F Reservoir is 2,638, which is equivalent to 204 fish/hectare. White perch appear to be the most abundant fish species in the reservoir, comprising over 90% of the total number of fish captured.
W80-04109

ZOOPLANKTON IN AN UPWELLING AREA OFF NORTHWEST AFRICA: COMPOSITION, DISTRIBUTION AND ECOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
M. Blackburn.
Deep Sea Research, Vol 26A, No 1, Part AA, p 41-56, January 1979. 3 Fig, 8 Tab, 28 Ref. NSF GX-33502 and OCE76-81172.

Descriptors: *Zooplankton, *Upwelling, *Africa, *Continental slope, *Continental shelf, Copepods, Distribution, Biomass, Ecology, Size, Predation, Advection, Distribution patterns, Spatial distribution, Secondary productivity, Dominant organisms, Systematics, Temporal distribution.

Mean zooplankton biomass increases from the inner continental shelf to the slope off northwest Africa, March-May 1974 in an upwelling area. The continental shelf is bounded by the 100-m isobath, beyond which there is a steep slope. Shelf biomass includes predominately small zooplankters between 0.1-0.5 mm, and slope biomass is predominately large animals > 1.0 mm. Organisms 0.5-1.0 mm make a small contribution to both. The inner shelf is a consistently poor area for zooplankton by comparison with the outer shelf and slope. Principal taxa by weight are Copepoda, Euphausiacea, Thaliacea and Coelenterata. Copepoda greatly predominate. Euphausiacea and Thaliacea are important only in the > 1.0mm group. Temporal changes in zooplankton biomass are moderate and mainly affect Copepoda and Thaliacea. Copepoda show more temporal change on the slope where they are mostly large than on the outer shelf where they are mostly small. Thaliacea change with time in the same way in both areas, which are occupied by the same population of large individuals. Estimated gains and losses to zooplankton from local biological conditions are much smaller than those from advection. In a 390 million sq m area across the outer shelf, where flow is almost always southward at all depths, daily change in biomass is estimated as follows: 10-50 billion g entering and leaving by advection, and 0.1-3.0 billion g entering and leaving as a result of local production and local fish predation. (Danovich-Wisconsin)
W80-04113

ADDITION OF NUTRIENTS TO A LAKE LEADS TO GREATLY INCREASED CATCH OF SALMON,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
R. J. LeBrasseur, C. D. McAllister, and T. R. Parsons.
Environmental Conservation, Vol 6, No 3, p 187-190, Autumn 1979. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Fish harvest, *Salmon, *Nutrients, *Productivity, *Lakes, *Great Central Lake(British Columbia), *Fish farming, *Fertilization, Fish management, Fisheries, Sockeye salmon, Vancouver Island(British Columbia), Canada, Fertilizers, Phytoplankton, Fish populations, Fish establishment, Nutrient requirements, Spawning, Fish migration, Juvenile fish, Fish.

During 1969-1970 about 100 tons of fertilizer were applied to Great Central Lake, Vancouver Island in hope that dissolved nutrients would increase production of sockeye salmon (Oncorhynchus nerka). Experiment results were favorable; both animal and plant production in this oligotrophic lake increased. Average weight of young salmon increased by 30%. The number of juveniles surviving from spring emergence to November increased nearly threefold. The number of fish migrating back to Great Central Lake increased seven times over 1969 fish numbers. Experiment costs were $5 million. Gross value of the salmon catch over four years (1973-1976) was $14.1 million. Thus the apparent benefit from fertilizer application to the lake was $9 million. In addition the experiment was responsible for an increased number of spawners, whose progeny would support fishing four to five years later. The added fertilizer is known commercially as 27-14-0 (27% N, 14% P205, 0% K20) and has a nitrogen-to-phosphorus ratio of 10:1. An organic supplement in the form of fish solubles was also added in small amounts in 1969 in order to provide chelation for trace elements contained in the organic fertilizer. Timing of the nutrient additions was adjusted to coincide with warming of surface waters. (Harris-Wisconsin)
W80-04114

POST-WAR LAND DRAINAGE, FERTILIZER USE AND ENVIRONMENTAL IMPACT IN NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
For primary bibliographic entry see Field 4A.
W80-04115

SEASONAL CHANGES IN STRUCTURE OF A SUBMERGED BLUEGREEN ALGAL/BACTERIAL COMMUNITY FROM A GEOTHERMAL HOSTSPRING,
Texas Univ. at Arlington. Dept. of Biology.
W. R. Fagerberg, and H. J. Arnott.
Journal of Phycology, Vol 15, No 4, p 445-452, December 1979. 8 Fig, 2 Tab, 23 Ref.

Descriptors: *Cyanophyta, *Aquatic bacteria, *Thermal springs, *Mimbres(NM), *Seasonal, *Temporal distribution, Water temperature, Analytical techniques, Thermal water, Geothermal studies, Light quality, Aquatic plants, Freshwater algae, Biomass, Spatial distribution, Speciation, Bacteria, Algae, Light, Light intensity, Volume, New Mexico.

Seasonal changes in a submerged blue-green algal/bacterial community at geothermal hotsprings in Mimbres, New Mexico correlate with seasonal changes in light intensity and duration. The community receives three h sunlight/d. Light is severely restricted in fall when tree leaves accumulate on the water surface. Total mat volume occupied by living organisms never exceeds 2%; volume remains relatively constant from January to July then drops sharply in November. Most of the living mat volume is occupied by bacteria (99%). Density values show a slight but steady decrease from a January high of 16 individuals/1000 micro sq m to a November low of 10 individuals/1000 micro sq m. Maximal distribution values for both blue-green algae and bacteria occur during spring and summer months. Three dominant blue-green algal cytospecies which represent the greatest amount of biomass, alternate in their abundance on a seasonal basis while the three dominant bacterial cytospecies remain the same. Blue-green algal/bacterial mat communities occur within a gelatinous matrix that also contains gas and water bubble chambers. Water temperature in which the mats are submerged shows little change over the year. Stereological techniques were used to measure biomass, density, distribution and species diversity. (Harris-Wisconsin)
W80-04117

MULTIDATE LANDSAT LAKE QUALITY MONITORING PROGRAM,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 7B.
W80-04118

SKELETONEMA POTAMOS (WEBER) HASLE AND CYCLOTELLA ATOMUS HUSTEDT (BACILLARIOPHYCEAE) IN THE PLANKTON OF RIVERS IN ENGLAND AND FRANCE,
Institute of Terrestrial Ecology, Cambridge (England); and Culture Centre of Algae and Protozoa,

Cambridge (England).
For primary bibliographic entry see Field 2I.
W80-04120

APPLYING PHOSPHORUS LOADING MODELS TO EMBAYMENTS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5B.
W80-04123

THE UPTAKE OF UREA BY CHLORELLA,
University Coll. of Swansea (Wales). Dept. of Botany and Microbiology.
I. A. Bekheet, and P. J. Syrett.
The New Phytologist, Vol 82, No 1, p 179-186, January 1979. 4 Fig, 5 Tab, 6 Ref.

Descriptors: *Chlorella, *Kinetics, *Ureas, *Marking techniques, Algae, Chlorophyta, Nutrients, Cytological studies, Metabolism, Tracers, Radioactivity techniques, Photosynthesis, Light, Darkness, Nutrient requirements, Cycling nutrients, Chromatography, Radioisotopes, Analytical techniques.

Experiments show that light stimulates uptake rates of radioactive urea by Chlorella. C-14 contained in radioactivated urea is taken up rapidly by urea-grown Chlorella cells. Uptake rates are considerably greater than those attained by passive diffusion and are much more rapid in light than in darkness. Uptake rates relate to urea concentration hyperbolically and K-m is 16.5 micro M. However, examination casts doubt on what is being measured when C-14 is taken up from (C-14) urea. After five minutes, only 45% of C-14 taken up is recovered in urea; moreover, although C-14 uptake rates are much lower in darkness than in light, rates at which C-14 disappear from the medium are not very much different. DCMU, an inhibitor of photosynthetic carbon dioxide fixation, inhibits markedly C-14 uptake in light. These findings strongly suggest that Chlorella metabolizes C-14 urea rapidly in either light or in darkness with carbon dioxide production which, in light, is converted to organic compounds by photosynthesis. Nevertheless, light stimulates urea uptake as shown when (C-14) urea in cells is extracted and separated by thin-layer chromatography. Since C-14 uptake is inhibited competitively by thiourea and (C-14) urea metabolism occurs so rapidly, it may be preferable to study Chlorella uptake mechanisms by using thiourea. (Danovich-Wisconsin)
W80-04124

THE POTENTIAL EFFECTS OF ENERGY RELATED ACTIVITIES ON THE SEASONAL TRAJECTORIES OF EPIPHYTIC MARINE DIATOMS,
City Univ. of New York. Dept. of Biology.
G. F. Coccetti, and J. J. Lee.
Hydrobiologia, Vol 67, No 1, p 51-80, November 1979. 9 Fig, 8 Tab, 44 Ref. ERDA E(11-1)3254, (C00)3254-28.

Descriptors: *Biological communities, *Diatoms, *Succession, *Niches, Cultures, Speciation, Ecology, Growth rates, Heavy metals, Oil, Algae, Plant groupings, Statistics, Seasonal, Epiphytes, Water quality, Sippewisset Marsh(MA), Jamaica Bay(NY), Southampton(NY), New York, Massachusetts.

Seasonal successional trajectories measured summer 1973 show that each species of transplanted and experimental diatom communities has a definable niche and if all experimental factors are equal, niches are expressions of competition pressures, synergisms and antagonisms exerted by coexisting community members. Very few generalizations could be made about individual species' behavior in any particular experiment. Diatom assemblages were manipulated at Sippewisset Marsh, Massachusetts, by an in-situ experimental apparatus capable of incubating these organisms without doing violence to the community itself. Epiphytic diatom community assemblages were taken from Jamaica Bay and Southampton, New York and from Sippewisset Marsh. A mixture of the inocula was also made and the effects of Fe, Cu, Cr, Pb, Zn and crude oil was tested. Since random environmental fluctuations were constant for all assemblages, individual species abundance was due to niche packing and interspecific restraints as well as changes in water quality. Twice as many species (40%) had their greatest niche breadth in the mixed community as did species in transplanted (20%) or native controls (17%). Medium enrichment with heavy metals and oil altered community structure and diversity. Cu and Cr assemblages initially followed oil and Pb trajectories but diverged later. Greatest species diversity occurred with Cu incubations. Fe enriched communities generally diverged from all the others. (Danovich-Wisconsin)
W80-04125

DISTRIBUTION OF POLLUTANTS FROM A NEW PAPER PLANT IN SOUTHERN LAKE CHAMPLAIN, VERMONT AND NEW YORK,
Michigan Univ., Ann Arbor. Dept. of Natural Resources.
For primary bibliographic entry see Field 5B.
W80-04126

NUMERICAL ABUNDANCE AND BIOMASS OF BACTERIA, ALGAE AND MACROBENTHOS OF A LARGE NORTHERN RIVER, THE ATHABASCA,
Waterloo Univ. (Ontario). Dept. of Biology.
D. R. Barton, and M. A. Lock.
Internationale Revue der Gesamten Hydrobiolgie, Vol 64, No 3, p 345-359, 1979. 6 Fig, 1 Tab, 42 Ref.

Descriptors: *Athabasca River(Alberta, Canada), *Bacteria, *Algae, *Benthos, *Sampling, Canada, Speciation, Biomass, Chlorophyll-a, Standing crop, Invertebrates, Diptera, River beds, Rivers, Seasonal, Sediments, Substrates, Sands, Mud, Particle size, Distribution, Spatial distribution.

Autumnal direct sampling of Athabasca River (northern Alberta, Canada) macrobenthos shows that bedrock fauna is similar in composition and numerical density to that reported from smaller streams, while a group of specialized chironomid larvae dominates the fauna of sand and mud. Invertebrate biomass is similar on coarse sand and mud and lower on fine sand. Numerical standing stocks show a decreasing order from coarse sand to mud to muddy sand to medium sand to fine sand. Larvae of an undescribed species of Parakiefferiella dominates coarse sand fauna. On bedrock, invertebrate biomass and sessile bacteria abundance are greatest close to the water's edge and at 3 m depth. Bacterial densities are within ranges for rocks in similar streams. Chlorophyll-a standing crop at 1.5 m is about one-half that found at 0.25 m. ATP levels are closely associated with numbers of small invertebrates (less than 6 mm) but not with bacteria or algae biomass. Benthic primary production probably contributes organic matter to the river, but is probably limited by rapid light attenuation due to extended periods of high turbidity during the open water season. Most of the energy available to benthic communities is probably allocthonous in origin. The average width of the river near Fort MacKay where sampling was done is about 400 m, main channel depth is at least 4.5 m during the open water season, and discharge ranges from 200 cu m/sec in winter to over 1700 cu m/sec in summer. (Harris-Wisconsin)
W80-04127

VOLATILE ORGANIC SULFIDES FROM FRESHWATER ALGAE,
Washington State Univ., Pullman. Dept. of Botany.
M. J. Bechard, and W. R. Rayburn.
Journal of Phycology, Vol 15, No 4, p 379-383, December 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Cyanophyta, *Freshwater, *Sulfur compounds, *Ecology, *Dimethyl sulfide, *Valley Road Pond(WA), Sulfur, Sulfides, Chlorophyta, Diatoms, Chrysophyta, Xanthophyta, Microenvironment, Gas chromatography, Sulfur bacteria, Speciation, Microbiology, Gases, Cultures, Eutrophication, Laboratory tests, Aquatic algae.

This study suggests that dimethyl sulfide (DMS) is the principle atmospheric sulfur carrier in freshwater ecosystems which support large communities of filamentous green and blue-green algae. DSM concentrations measured April-September 1973, ranged from trace amounts in spring and fall to 70,000 Ng/l in summer in Valley Road Pond, near Pullman, Washington. Highest DMS concentrations occur when Nostoc are abundant and Spirogyra and Oedogonium mats are decaying. Gas chromatography analysis of nonaxenic cultures of Nostoc alone show it produces only small DMS amounts. Analyses of Oedogonium and Spirogyra, young and old cultures indicate that hydrogen sulfide (H2S), DMS and dimethyl disulfide (DMDS) occur only in senescent cultures. Bacterial contamination reduction in these cultures with penicillin G results in no detectable sulfur production. Algal axenic cultures not endemic to the pond were also analyzed. Six Cyanophyta species produce DMS and DMDS. Two produce methyl mercaptan. Chlorophyta, Xanthophyta and Bacillariophyta do not produce detectable sulfur compounds. Therefore, sources of DMS depend on algal community composition. In freshwater ecosystems which support large Chlorophyta, Xanthophyta and Bacillariophyta populations, DMS is probably not algal in origin. Rather, it is bacterial in origin with decaying algae acting as a substrate for bacterial growth. In freshwater ecosystems with Cyanophyta dominating, DMS is not only bacterial in origin but it is also synthesized directly by blue-green algae. (Danovich-Wisconsin)
W80-04128

SOME PHOTOSYNTHETIC CARBON FIXATION PROPERTIES OF SEAGRASSES,
Tel Aviv Univ. (Israel). Dept. of Botany.
S. Beer, and Y. Waisel.
Aquatic Botany, Vol 7, No 2, p 129-138, October 1979. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Marine algae, *Photosynthesis, *Carbon dioxide, *Plant physiology, *Carbonates, Carbon, Red Sea, Mediterranean Sea, Tracers, Chloropyyll, Speciation, Cymodocea nodosa, Halophila ovalis, Enzymes, Laboratory tests, Ecology, Adaptation, Biochemistry, Sea water, Israel.

The main exogenous carbon form utilized by seagrass species is HC03-; this agrees well with high HC03- concentrations found in seawater compared with C02 concentrations. The former concentration at 2.5 mM is saturating for photosynthesis in these plants. One Mediterranean seagrass species, Cymodocea nodosa, and three Red Sea species, Halophila ovalis, H. uninervis and Syringodium isoetifolium were used in experiments. C. nodosa and H. ovalis net photosynthetic rates at saturating HC03- concentrations are 0.4 and 0.05 micro moles 02/min mg chl, respectively. When additional C02 is added, photosynthetic rates increase. In C. nodosa, photosynthetic rates are three times higher at saturating C02 concentrations than at saturating HC03- concentrations. In H. ovalis, photosynthetic rates are similar at saturating concentrations of both carbon forms. Whether HC03- is fixed directly by phosphoenolpyruvate carboxylase or transformed to C02 and fixed by ribulosebiphosphate carboxylase probably depends on the levels of these and other enzymes as well as which carbon form is available. C14 pulse-chase experiments show that H. uninervis and S. isoetifolium are C3 plants, even though they posses features indicating C4 metabolism. These plants are unlike Thalassia testudinum, shown earlier to be a C4 plant. Variations in photosynthetic pathways reflect an ability of seagrasses to adapt to various ecological conditions. (Danovich-Wisconsin)
W80-04129

PRIMARY PRODUCTION OF ALGAE GROWING ON NATURAL AND ARTIFICIAL AQUATIC PLANTS: A STUDY OF INTERACTIONS BETWEEN EPIPHYTES AND THEIR SUBSTRATE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-04131

ORIGINS OF OCEANIC PLANKTON IN THE MIDDLE ATLANTIC BLIGHT,
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W80-04132

EPIPELIC AND EPILITHIC DIATOM ASSEMBLAGES IN MONTEZUMA WELL NATIONAL MONUMENT, ARIZONA,
Minnesota Univ., St. Paul. Dept. of Botany.
D. B. Czarnecki.
Journal of Phycology, Vol 15, No 4, p 346-352, December 1979. 3 Fig, 2 Tab, 26 Ref.

Descriptors: *Diatoms, *Montezuma Well National Monument(AZ), *Biological communities, *Benthic flora, *Correlation analysis, Speciation, Systematics, Seasonal, Light intensity, Biomass, Water chemistry, Epilithic, Epipelic, Sediments, Achnanthes, Cocconeis, Cyclotella, Fragilaria, Rhiocosphenia, Synedra, Statistics.

Epipelic assemblages at Montezuma Well National Monument, Arizona, measured May 1976-April 1977, show a tri-dominant association of Cyclotella pseudostelligera, Cocconeis placentula and Achnanthes linearis. Epilithic assemblages are also tridominant: Rhoicosphenia curvata, C. pseudostelligera and Synedra ulna. Of the 83 diatom taxa observed, 51 are common to both assemblages, 24 are restricted to the epipelon and eight to the epilothon. C. pseudostelligera clearly dominates the epipelon throughout most of the year, ranging 74.6%-12% in relative abundance. The epilithon is clearly dominated by R. curvata, ranging 61%-10% in relative abundance. Based on seasonal abundance patterns, C. pseudostelligera and S. ulna outcompete other taxa during high light intensity and duration periods, while Fragilaris construens responds more favorably under low light intensity and duration. A. linearis, R. curavata and C. placentula are more tolerant of a wide range of light intensities and durations. On a yearly basis, both assemblages exhibit slight similarity. Mean diversity values and similarity indices are unacceptable when comparing assemblages with few highly abundant taxa. The use of dissimilarity indices are recommended. Montezuma Well National Monument, located 80 km south of Flagstaff, is a circular limestone depression 0.76 ha and 6.7 m deep. The system exhibits nearly constant nutrient levels and an unusually high free C02 content (690 mg/l). (Danovich-Wisconsin)
W80-04133

PHYSIOLOGICAL ASPECTS OF PRIMARY PRODUCTION IN SEAGRASSES,
Gatty Marine Lab., St. Andrews (England).
For primary bibliographic entry see Field 2L.
W80-04134

SPATIAL AND TEMPORAL PATTERNS OF TEMPERATURE, ALKALINITY, DISSOLVED OXYGEN AND CONDUCTIVITY IN AN OLIGO-MESOTROPHIC, DEEP-STORAGE RESERVOIR IN CENTRAL TEXAS,
Southwest Texas State Univ., San Marcos. Aquatic Station.
H. H. Hannan, I. R. Fuchs, and D. C. Whitenberg.
Hydrobiologia, Vol 66, No 3, p 209-221, October 1979. 12 Fig, 23 Ref.

Descriptors: *Canyon Lake(TX), *Stratification, *Dissolved oxygen, *Conductivity, *Alkalinity, *Spatial distribution, *Trophic levels, Reservoirs, Epilimnion, Seasonal, Anaerobic conditions, Temporal distribution, Water temperature, Turbidity, Impounded waters, Physicochemical properties, Physical properties, Chemical properties, Hypolimnion, Carbonates, Environmental effects.

Physicochemical analyses of impounded waters in Canyon Lake, Texas, February 1976-January 1977 show that transparency increases and surface bicarbonate alkalinity and conductivity decrease with distance down reservoir. Greater turbidity at riverine stations is caused by greater plankton quantities and heavier silt loads. Transparency fluctuations in the reservoir are due to plankton population fluctuations. Riverine stations exhibit a wider temperature range than reservoir waters. Thermal stratification is sufficiently established by June to develop an anoxic hypolimnion. Epilimnion depth increases and hypolimnion waters continue to warm through September. Increased epilimnion depth is caused by withdrawal of cold water from the hypolimnion. Epilimnion alkalinity decreases during summer as a result of photosynthetic bicarbonate uptake. Hypolimnetic alkalinity increases are due to increases in carbon dioxide from decomposition. Bicarbonate concentrations decrease 16-31% with distance through the reservoir; this is caused by bicarbonate utilization in primary phytoplankton productivity. A downstream pattern of hypolimnetic oxygen depletion was observed. Oxygen concentrations less than 1 mg/l occur in upstream sections in June and near the dam in August; this is due to smaller hypolimnetic volume and greater input of oxidizable sediments in upstream areas. Specific conductance exhibits temporal and spatial variations similar to those of bicarbonate and calcium, the predominant ionic species. (Danovich-Wisconsin)
W80-04135

UPTAKE AND RELEASE OF NUTRIENTS BY AQUATIC MACROPHYTES,
Mankato State Univ., MN. Dept. of Biology.
B. H. Hill.
Aquatic Botany, Vol 7, No 1, p 87-93, September 1979. 2 Fig, 24 Ref.

Descriptors: *Aquatic plants, *Cycling nutrients, *Agricultural runoff, *Macrophytes, *Pondweeds, *Kinetics, Potamogeton nodosus, Potamogeton pectinatus, Potamogeton crispus, Nitrogen, Phosphorus, Carbon, Nutrients, Organic matter, Biodegradation, Degradation(Decomposition), Decomposing organic matter, Biomass, Minnesota, Drainage area, Organic matter, Organic compounds, Nutrient budgets.

Analysis of three aquatic macrophytes species, Potamogeton nodosus, P. pectinatus and P. crispus, from an agricultural drainage ditch in south-central Minnesota during the 1976 growing season shows similar nutrient accumulation and breakdown among species and sites. Nitrogen and phosphorus contents of the aquatic macrophytes are highest at the beginning of the growing season and gradually declined throughout the season. Peak biomass is 336 dwt/sq m for all three species combined. Accumulated nutrients total 5.65 g dwt/sq m for nitrogen and 1.29 g dwt/sq m for phosphorus. Average nutrient values for three species combined are 26.59 mg N/g dwt, 5.89 mg P/g dwt, and 353.7 mg C/g dwt. Species specific breakdown rates and nutrient concentrations are given for P. nodosus only; breakdown rates are 0.0312/d and 0.0408/d at two different sites. Nutrient concentrations remain relatively constant throughout the study. Carbon to nitrogen ratios range from 13.1:1 to 16.2:1. (Harris-Wisconsin)
W80-04136

TURBULENCE AND PHYTOPLANKTON DIVERSITY: A GENERAL MODEL OF THE 'PARADOX OF PLANKTON',
Maryland Univ., Cambridge. Horn Point Environmental Lab.
W. M. Kemp, and W. J. Mitsch.
Ecological Modelling, Vol 7, No 3, p 201-222, September 1979. 9 Fig, 3 Tab, 68 Ref.

Descriptors: *Mathematical models, *Phytoplankton, *Species diversity, *Turbulence, *Simulation analysis, *Population dynamics, Speciation, Ecology, Movement, Water circulation, Competition, Niches, Ecological distribution, Nutrients, Limiting factors, Growth rates, Life history studies, Flow, Hydrobiology, Environmental effects, Turnovers.

Simulation results from a mathematical model investigating the effects of both advective and turbulent water movements on the growth of three competing phytoplankton species, show that coexistence of all three species occurs only under turbulent regimes. Plankton diversity is maintained through metabolic responses to a randomly-fluctuating, turbulent environment. Simulataneous coexistence of all three species also occurs only when the primary period of turbulent events is one day, close to turnover rates for phytoplankton populations. In the absence of water motion, no two species are able to coexist, while under hypothetical advection conditions without turbulence (laminar flow) just two species occur contemporaneously. The 'paradox of plankton' states that a diverse array of phytoplankton species invariably coexist. However, the principle of competitive exclusion states that the species with greatest competitive advantage for a given ecological niche utilize environmental resources associated with that niche to such an extent that no other organism simultaneously occupies the same niche. The aquatic medium in which phytoplankton live is continuously being mixed by turbulent eddies. The model investigates possible relationships between phytoplankton diversity and hydrodynamic turbulence in natural waters. Diversity amongst species which compete for the same niche require an environment which fluctuates with a periodicity approaching turnover times for those species; phytoplankton turnover ranges 0.5-5 days. (Danovich-Wisconsin)
W80-04138

BUOYANCY OF NATURAL POPULATIONS OF MARINE PHYTOPLANKTON,
Bergen Univ. (Norway). Inst. of Marine Biology.
C. Lannergren.
Marine Biology, Vol 4, No 1, p 1-10, 1979. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Buoyancy, *Phytoplankton, *Diatoms, *Floating, *Vertical migration, Population, Fjords, Physical properties, Marine algae, Density, Cytological studies, Nutrients, Aging(Biological), Chlorophyll, Bergen(Norway), On-site data collections, On-site investigations, Growth stages, Population dynamics, Distribution, Norway.

Positive buoyancy was observed only once in a diatom spring bloom, February-April 1977 in a fjord near Bergen, Norway. The investigation was carried out with natural phytoplankton populations under approximate in-situ conditions. Buoyancy was studied in 2.2 m long, transparent Plexiglas tube filled with sea water. The paper concentrates on a diatom spring bloom, but also includes results from a 1976 flagellate-dominated autumn bloom. Positive buoyancy, observed once, is associated with intense growth in the initial bloom phase. Neutral buoyancy occurs on some occasions in the first phase of the bloom, while negative buoyancy occurs in most experiments. Mean sinking rates for the entire chlorophyll content vary 0.3-2.2 m/d. Sinking rates for individual fractions range 0-9 m/d. Results show higher sinking rates in the post-bloom period, indicating that either senescent cells sink faster than actively growing cells or that cells adapt to changing nutrient concentrations. Skeletonema costatum and Chaetoceros dominate the spring bloom. In autumn blooms dominated by coccolithophorids and small, athecate flagellates, positive buoyancy occurs in two out of three cases. As these algae are small and motile, vertical distribution is probably little influenced by sinking. High nutrient concentrations permit growth of large diatoms which, apart from a short period, have comparatively high sinking rates, while low concentrations favor dominance of small flagellates with low or negligible sinking rates. (Danovich-Wisconsin)
W80-04139

IN SITU MEASUREMENTS OF NET PRIMARY PRODUCTION IN A COLORADO MOUNTAIN STREAM,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
R. W. Pennak, and J. W. Lavelle.
Hydrobiologia, Vol 66, No 3, p 227-235, October 1979. 3 Fig, 4 Tab, 40 Ref.

Descriptors: *Primary productivity, *Streambeds, *On-site investigations, *Arkansas River(CO), Photosynthesis, Metabolism, Streams, Heterotrophy, Biological communities, Mountains, On-site data collections, Respiration, Seasonal, Water

temperature, Water chemistry, Autotrophy, Benthos, Biomass.

Net primary productivity of the bottom community ranged from -27.38 to 35.59 g C/sq m yr, indicating a range of heterotrophy to autotrophy in the Arkansas River, an unpolluted Colorado white-water stream 1452-2835 m a.s.l., November 1965-1966. Four stations vary between heterotrophy and autotrophy at different times. One station exhibits only heterotrophy; it is unpolluted and located just above the city of Salida in the foothills of the Rocky Mountains. One station exhibits only autotrophy; it is located just upstream from Pueblo in the plains region east of the mountains. Negative primary productivity readings reflect overall dominating heterotrophic conditions; algal respiration and action of bacteria and fungi on organic detritus substrate more than balance algal photosynthesis so there is a net dissolved oxygen loss after 24 hr. There are no seasonal trends and no correlations with water temperature and chemistry. Bottom fauna biomass does not correlate with net community productivity. Five stations have poor biomass with less than 10 g wet wt/sq m, whereas Salida station biomass averages 144 g/sq m. Dissolved oxygen and water temperature are electronically monitored in an undisturbed section of rubble bottom enclosed by a large plastic dome set into the substrate. The entire chamber was completely filled with stream water and set below stream water level. Water in the dome is circulated rapidly by a small submerged electric pump. (Danovich-Wisconsin)
W80-04140

ANALYSIS OF HETEROTROPHIC MICROPLANKTON IN AN UPWELLING AREA,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
Y. I. Sorokin, and J. E. Kogelschatz.
Hydrobiologia, Vol 66, No 3, p 195-208, October 1979. 10 Fig, 6 Tab, 20 Ref.

Descriptors: *Upwelling, *Microorganisms, *Primary productivity, *Heterotrophy, *Punta San Juan, Peru, *Marine algae, Biomass, Bacteria, Phytoplankton, Gymnodinium, Mesodinium, Respiration, Organic matter, Protozoa, Red tide, Dinoflagellates, Density, Nutrients, Growth rates.

In freshly upwelled water in the Punta San Juan region off Peru, April-May 1977, the main component of the planktonic community were microheterotrophs, the development of which precede that of phytoplankton because of independence of the stability of water mass and light conditions. Microheterotroph respiration exceeds by threefold primary photoplankton production. During the movement of upwelled water, biomass increases 1000 times in four days. Near the bloom, biomass in 10 g wet wt/cu m and primary production is 8.6 g C/sq m d, close to maximum for natural oceanic plankton communities. Values of P/B coefficients of phytoplankton reach 7-10/d. Analyses reveal a rich microheterotroph population in the center of upwelling. Bacteria numbers reach 0.3-0.7 million/ml and biomass 10-50 mg C/cu m. Microbial production here is 5-15 mg C/cu m d. Protozoa also flourish in the center of upwelling; wet biomass reaches 1 g/cu m, the highest concentration of protozoa ever recorded in seawater. Dominating species include Strombidium ciliates and various tintinnids. During transects normal to the coast line, abundant dinoflagellate populations (5-40 thousand/l) of Gymnodium and Prorocentrum are found in anoxic waters 50-100 m. In an area over the shelf break and continental slope, a red tide was caused by an intense bloom of ciliate Mesodimium rubrum. This ciliate is a functional autotroph that harbors pseudosymbiotic chloroplasts of cryptomonad origin. Biomass reached 50-70 g wet wt/cu m and cell density 2-4 million/l at the surface. (Danovich-Wisconsin)
W80-04145

PHOTOSYNTHETIC CARBOXYLATING ENZYMES IN MARINE PHYTOPLANKTON,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
H. E. Glover, and I. Morris.
Limnology and Oceanography, Vol 24, No 3, p 510-519, May, 1979. 7 Fig, 2 Tab, 27 Ref. NSF OCE 77-08722.

Descriptors: *Enzymes, *Biochemistry, *Photosynthesis, *Marine algae, *Phytoplankton, *Primary productivity, Marine microorganisms, Cultures, Laboratory tests, Population, Correlation analysis, Algae, Cytological studies, Analytical techniques, Sea water, Metabolism, Plant physiology, Chemical reactions, Gulf of Maine, Assay, Bioassay.

Data from both cultures and natural marine phytoplankton populations show that carbon fixed by photosynthesis is always greater than that fixed by ribulose-l, 5-besphosphate carboxylase (RUBPCase) and phosphoenolpyruvate carboxylase (PEPCase). Therefore, instantaneous measurement of those carboxylating enzymes does not indicate potential photosynthetic capacity. When RUBP is solubilized it rapidly breaks down and forms products which may inhibit RUBPCase activity. Alternatively, the difference between carboxylase activity and photosynthesis may reflect reactions during assimilation of (C-14) bicarbonate by whole cells and not included in enzymatic assays. The ratio of carbon fixation by whole cells (P-max) to that by carboxylating enzymes such as RUBPCase and PEPCase is not constant. The ratio may indicate the cell's physiological state since it is greatest when photosynthetic rate is highest. The discrepancy between photosynthesis and carboxylase activity is significantly greater in natural populations than in all cultures examined. PEPCase is quantitatively important only when photosynthetic rate is low. The lack of a significant correlation between P-max and RUBPCase:PEPCase ratio in natural populations is probably due to species differences, since Dunaliella has a 29.2 ratio when P-max is high while chrysophyte and diatom cultures have ratios ranging from an eighth to half this value. Water samples were collected from Gulf of Maine and Boothbay Harbor, Maine, December 1977-July 1978; six different algal species were used in the cultures. (Danovich-Wisconsin)
W80-04146

GROWTH, CHLOROPHYLL AND MINERAL NUTRIENT STUDIES ON PHALARIS ARUNDINACEAE L. IN THREE SCOTTISH LOCHS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
Y. B. Ho.
Hydrobiologia, Vol 63, No 1, p 33-43, March 1979. 11 Fig, 6 Tab, 15 Ref.

Descriptors: *Aquatic plants, *Chemical analysis, *Plant growth, *Chlorophyll, *Scotland, Lakes, Phalaris arundinaceae, Forfar Loch(Scotland), Balgavies Loch(Scotland), Loch of the Lowes(Scotland), Growth rates, Plant tissues, Nutrients, Leaves, Root development, Trophic level, Sewage effluents, Standing crops, Seasonal, Biochemistry, Plant physiology, Plant morphology.

During the 1975 growing season, general growth characteristics, chlorophyll content and mineral level were analyzed in reed canary-grass, Phalaris arundinaceae, growing in three shallow lowland Scottish lochs, Forfar Loch (polytrophic), Balgavies (eutrophic) and Loch of the Lowes (mesotrophic). Average maximum shoot heights (160 cm) are similar in all three lochs. Phalaris standing crops are 1151 g dwt/sq m in Forfar, 405 g dwt/sq m in Balgavies, and 440 g dwt/sq m in Lowes. Maximum chlorophyll contents in all three lochs is 8-9 mg/g dwt leaf. Leaf chlorophyll contents peaks twice; the first occurs late April in all three lochs. The second occurs June-July in Balgavies and Lowes while in Forfar it occurs July-August. Chlorophyll content steadily decreases for the rest of the growing season. Some shoot minerals reach maximum in summer and then remain constant for the rest of the season. This pattern applies to C, P, Na and Fe for plants in all lochs, as well as K, Ca and Mg for Balgavies and Lowes plants, indicating mainerals are retained and not released before tissue degradation. The second mineral distribution pattern involves a large decline after summer peak. Nitrogen in all lochs and K, Ca and Mg in Forfar plants follow this second pattern. Forfar shoots also contain a disproportionately greater amount of N, P, Na and Fe compared with the other two lochs; this is probably due to enrichment from sewage effluents. (Danovich-Wisconsin)
W80-04147

PRIMARY PRODUCTION AND BACTERIOPLANKTON IN FISH PONDS WITH MONO AND POLY-CULTURE,
Kalyani Univ. (India). Dept. of Zoology.
B. B. Jana.
Hydrobiologia, Vol 62, No 1, p 81-87, January 1979. 1 Fig, 5 Tab, 10 Ref.

Descriptors: *Primary productivity, *Bacteria, USSR, *Fish Farm Nivka(USSR), Kiev(USSR), *Fish farming, Summer, Plankton, Fish, Carp, Water temperature, Biochemical oxygen demand, Seasonal, Heterotrophy, Population, Respiration, Photosynthesis, Correlation analysis, Grazing, Fish food organisms, Speciation.

No definite relationship exists between primary productivity and bacterioplankton in three fish ponds with mono-/and polyculture in the Fish Farm Nivka, Kiev, USSR, May-September 1975; this probably results from the low percentage of autotrophic photosynthetic bacteria and abundance of heterotrophic bacteria. Biochemical oxygen demand directly correlates with oxygen respiration losses due to bacterial populations however, biochemical oxygen demand does not correlate with total bacterioplankton population. Net photosynthetic oxygen production over 24 h is very small in ponds with mono-/and polyculture, indicating that phytoplanktonic algae are being heavily grazed by herbivorous fishes. Primary production in terms of oxygen release are not pond specific even though fish culture practices differ. Gross primary production averages are 21.54 Kcal/sq m (monoculture), and 22.00-24.09 Kcal/sq m (polyculture). Maximal oxygen production occurs in July; this is coupled with increasing water temperature. Values then tend to decline and reach a minimum in September. Monoculture ponds contain only common carp, whereas common carp (Cyprinus carpio), silver carp (Hypophthalmichthys molitrix), grass carp (Ctenopharyngodon idella) and big heads (Aristicthys nobilis) are reared in polyculture ponds. (Danovich-Wisconsin)
W80-04148

PHYTOPLANKTON MODELING INVOLVING RANDOM RATE CONSTANTS. PART I: DETERMINISTIC SETTING,
American Univ., Washington, DC.
R. W. Jernigan, and C. P. Tsokos.
The International Journal of Environmental Studies, Vol 14, No 2, p 97-105, 1979. 4 Fig, 15 Ref.

Descriptors: *Phytoplankton, *Model studies, *Primary productivity, *Ecosystems, Sea water, Nutrients, Zooplankton, Stochastic processes, Light intensity, Temperature, Absorption, Predation, Spatial distribution, Euphotic zone, Numerical analysis.

A system of nonlinear deterministic differential equations describe the flow of chemical nutrients through three components of a marine ecosystem, the phytoplankton, zooplankton and stock nutrient in the euphotic zone. The biological activities considered include: nutrient absorption by phytoplankton, extracellular release by phytoplankton, predation by zooplankton, and death and excretion of zooplankton. The parameters governing these activities, such as rates of nutrient uptake, zooplankton excretion and predation, were determined. Light and temperature fluctuations, spatial distributions of organisms, and detritus as the source of zooplankton food were not considered in the model. Through the use of numerical solutions and graphical presentations, the behavior of the model was studied. The most prominent characteristic of the model was the dampened oscillatory behavior of predatory-prey systems. Several parameter configurations were examined to determine their effect on the solutions. It was found that large values of the nutrient uptake coefficient, extracellular release rate and zooplankton death rate, increased the model's oscillatory behavior. The linear deterministic system was also developed in the study. (Harris-Wisconsin)

W80-04151

GROWTH AND POPULATION STUDIES ON TILAPIA GALILAEA IN LAKE KINNERET,
Israel Oceanographic and Limnological Research Ltd., Haifa.
For primary bibliographic entry see Field 5G.
W80-04152

PRODUCTION OF VITAMIN B12, THIAMINE, AND BIOTIN BY FRESHWATER PHYTOPLANKTON,
Kochi Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 2H.
W80-04169

DISTRIBUTION AND QUANTITATIVE DEVELOPMENT OF AQUATIC MACROPHYTES IN RELATION TO SEDIMENT CHARACTERISTICS IN OLIGOTROPHIC LAKE KALGAARD, DENMARK,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.
K. Sand-Jensen, and M. Sondergaard.
Freshwater Biology, Vol 9, No 1, p 1-11, February, 1979. 10 Fig, 6 Tab, 40 Ref.

Descriptors: *Oligotrophy, *Distribution, *Lake Kalgaard(Denmark), *Aquatic plants, *Sediments, *Organic matter, *Submerged plants, Macrophytes, Biomass, Speciation, Nutrients, Carbon dioxide, Adaptation, Ecology, Photosynthesis, Light intensity, Nitrogen, Plant physiology, Organic soils, Organic compounds, Phosphorus, Inorganic compounds, *Denmark.

An increasing sediment organic content at 0-0.75 m depth in Lake Kalgaard, Denmark creates a physiologically richer medium for isoetid plant species. Vegetational biomass, above-ground biomass fraction, and individual plant weight all increase with sediment organic content. At the same time, interstitial carbon dioxide, extractable inorganic nitrogen and exchangeable phosphorus concentrations increase. Kalgaard, a small, 10.5 ha lake with 4.65 m mean depth, was examined October 1975-October 1977. Vegetation is dominated by submerged isoetid species. Emergent and floating-leaved macrophytes are confined to sheltered lake parts with high organic sediments. Submerged species have a high cover area and biomass: Littorella uniflora forms compact stands with 112 g organic dwt/sq m mean biomass; Isoetes lacustris shoots are more scattered but attain 66 g organic dwt/sq m mean biomass. These two species account for 99% of the submerged macrophyte biomass. Littorella dominates 0-2 m zone and Isoetes dominates the 2-4.5 m zone. Littorella has a higher photosynthetic capacity (23 micro g 02/sq cm h) than Isoetes (19.5 micro g 02/sq cm h) at 15C and saturating irradiance. Littorella biomass seasonal variation is small. Lake Kalgaard has only 2.2-2.5 mg N/l. Rosette growth form and great below-ground isoetid biomass (20-65%) are seen as adaptations to oligotropophic ecological conditions such as low inorganic carbon and nutrient concentrations in the water. (Danovich-Wisconsin)
W80-04172

WATER QUALITY AND MINING: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W80-04180

DOMESTIC WATER SUPPLIES, HEALTH AND POVERTY: A BRIEF REVIEW,
For primary bibliographic entry see Field 6D.
W80-04183

MAN-INDUCED MODIFICATIONS IN ESTUARIES OF THE NORTHERN GULF OF MEXICO: THEIR IMPACTS ON FISHERY RESOURCES AND MEASURES OF MITIGATION,
Bureau of Land Management, Albuquerque, NM.
R. A. Diener.
In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats, held Fort Collins, CO on July 16-20, 1979. Forest Service General Technical Report RM-65, p 115-120, 1979. 17 Ref.

Descriptors: *Estuaries, *Pollution abatement, *Environmental effects, *Resources development, Powerplants, Oil, Gases, Fisheries, Habitat improvement, *Outer Continental Shelf, Gulf of Mexico.

The commercial and sport fisheries of the Gulf of Mexico are heavily dependent on the estuaries of the northern Gulf coast. A large variety of man-induced modifications in these estuaries are threatening these resources and the quality of the supporting habitat. This report summarizes potential impacts on the habitat and resource for each type of modification and lists mitigative measures which may be taken to offset these impacts. (Sinha-OEIS)
W80-04191

MITIGATING OIL SPILL DAMAGE--ECOLOGICALLY RESPONSIBLE CLEAN-UP TECHNIQUES,
Chemical Manufacturers Association, Washington, DC.
G. V. Cox, and E. B. Cowell.
In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats, held Fort Collins, CO on July 16-20, 1979. Forest Service General Technical Report RM-65, p 121-128, 1979. 43 Ref.

Descriptors: *Oil spills, *Pollution abatement, *Safety factors, *Oil pollution, Ecology, Water pollution, Environmental effects, Resources development, *Outer Continental Shelf.

Effective mitigation requires preplanning experience, ecological input to planning and the event, and a thorough understanding of political and social demands in oil spill clean-up programs. Attention to public safety should receive primary attention before the ecological and social considerations. The clean-up techniques and their results are analyzed. (Sinha-OEIS)
W80-04192

COASTAL IMPACT MITIGATION AND OCS-INDUCED OIL AND GAS DEVELOPMENT: A PERSPECTIVE OF THE CLEAN WATER ACT'S SECTION 404 GUIDELINES,
Environmental Protection Agency, Washington, DC. Office of Water Planning and Standards.
C. R. Terrell, and L. R. Shanks.
In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats, held Fort Collins, CO on July 16-20, 1979. Forest Service General Technical Report RM-65, p 270-275, 1979. 3 Ref.

Descriptors: *Resources development, *Oil pollution, *Ecosystems, *Environmental effects, *Pollution abatement, Water pollution effects, Ecosystems, Coasts, Dredging, Spoil banks, *Outer Continental Shelf, Petroleum industry.

In recent years the petroleum industry has increased its development effort of oil and gas resources on the nation's Outer Continental Shelf (OCS), while concomitantly there has been a rapid increase in coastal development by the petroleum industry and others. Environments and ecosystems have sustained large alterations, leading to reduced productivity and loss of prime fish and wildlife habitat. The Clean Water Act of 1977 Guidelines mandate the examination of practical alternatives to the discharge of dredged or fill material. A general evaluation determines the possibility of a chemically polluted sediment. 'Guidelines to Minimize Impacts' are incorporated concerning the substrate, water quality, tidal fluctuations, currents, salinity and other characteristics. Particular attention must be given to minimize construction impacts to special aquatic sites, such as sanctuaries, refuges, wetlands, vegetated shallows and coral reefs. Based on the Factual Determinations which are made, the Corps of Engineers must decide if the proposed action is in compliance with the S404 Guidelines, and thus whether or not to issue the permit. (Sinha-OEIS)
W80-04193

PRE-IMPACT PROCESS ANALYSIS: DESIGN FOR MITIGATION,
LGL Ecological Research Associates, Grand Junction, CO.
J. C. Truett.
In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats, held Fort Collins, CO on July 16-20, 1979. Forest Service General Technical Report RM-65, p 355-360, 1979. 9 Ref.

Descriptors: *Resources development, *Pollution abatement, *Water pollution effects, *Environmental effects, Oil pollution, Habitats, Ecology, Baseline studies, Alaska, *Outer Continental Shelf, Petroleum development, Environmental impact, Process analysis, Beaufort Sea.

A study of physical and biological processes supporting important fish and wildlife species along Alaska's Beaufort Sea coast suggests how petroleum development can proceed with the least possible impact. The study's strategy--process analyses-- is generic in nature and is broadly applicable for identifying mitigative measures to accompany many kinds of development. This strategy is preferable to a more traditional inventory-based environmental assessment. (Sinha-OEIS)
W80-04194

THE FISHERY CONSERVATION AND MANAGEMENT ACT AS A TOOL FOR MITIGATION IN OUTER CONTINENTAL SHELF PETROLEUM DEVELOPMENT,
Woods Hole Oceanographic Institution, MA. Marine Policy and Ocean Management Program.
A. Rieser, and J. Spiller.
In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats, held Fort Collins, CO on July 16-20, 1979. Forest Service General Technical Report RM-65, p 653-664, 1979. 3 Fig, 60 Ref.

Descriptors: *Resources development, *Environmental effects, *Water pollution effects, Oil pollution, Fisheries, Oil spills, *Outer Continental Shelf, Georges Bank, Petroleum development, Fishery Conservation and Management Act.

Georges Bank, on the Northwest Atlantic Continental Shelf, represents one of the world's most productive fisheries; yet, the adverse environmental effects associated with Outer Continental Shelf (OCS) petroleum development threaten this productivity. Current and proposed regulations applicable to OCS petroleum development inadequately protect critical fishery habitats on the Georges Bank. The Fishery Conservation and Management Act of 1976 (FCMA), through the regional Fishery Management Plans (FMP), provides a process for the definition and protection of these critical fishery habitats. On the Georges Bank, this operation involves the identification of spawning and prime grounds of species of concern and then the inclusion of these areas in the FMPs. Thus, by incorporating such critical areas into a FMP approved by the Secretary of Commerce, these areas would receive special consideration, so that the adverse effects of offshore development on fisheries would be minimized. (Sinha-OEIS)
W80-04195

THE MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF BASELINE ENVIRONMENTAL SURVEY - MAFLA 1977/1978. VOLUME 1-B. EXECUTIVE SUMMARY REPORT.
Dames and Moore, Los Angeles, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 228, Price Codes: A03 in paper copy, A01 in microfiche. Final Report to Bureau of Land Management, January 1979. 30 p, 16 Fig. AA550-CT7-34.

Descriptors: *Baseline studies, *Environmental effects, *Resources development, Water quality,

Ecosystems, Monitoring, Surveys, *Outer Continental Shelf, Mississippi, Alabama, Florida.

The prime purpose of the MAFLA program was the determination of ongoing or potential impacts on the outer continental shelf (OCS) environment from oil and gas development. The Executive Summary Report is organized along the same lines as the Program Synthesis Report, with sections on methodology, geology, physical oceanography, chemistry and biology. A brief summary and lists of recommended monitoring parameters and major deficiencies in the data base are also included. No attempt has been made to support those lists in detail or uniformly within the text of this volume. However, the reader requiring such backup is referred to Volume I-A from which both lists were derived. (Sinha-OEIS)
W80-04196

OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS: AN OVERVIEW OF MODELING EFFORTS AND NEEDS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
J. H. Allender, J. D. Ditmars, R. A. Paddock, and K. D. Saunders.
In: Proceedings of: Fifth Ocean Thermal Energy Conversion Conference, held Miami Beach, Florida, February 20-22, 1978, Conf - 780236 Lavi, A. (ed.), p III-165-III-185, September 1978. 2 Tab, 22 Ref.

Descriptors: *Energy conversion, *Thermal powerplants, *Models, *Baseline studies, Resources development, Environmental effects, Thermal pollution, Water pollution, *Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC).

The present overview of studies of the effects of ocean thermal energy conversion (OTEC) plant operation on the physical environment of the ocean includes a review of the pertinent results of past and contemporary model efforts in terms of their implications for OTEC development and suggestions for future research consistent with OTEC timetables. Particular consideration is given to the areas of utilization of the thermal resource, effects of a single OTEC plant, and aggregate effects of many OTEC plants. These potential effects include modification of the local temperature, salinity, and nutrient distributions, induced changes in mixed-layer depths and sea-surface temperatures, and dispersal of biocides or working fluids (due to leaks). Review of model capabilities and limitations suggests that physical model studies also are needed to meet near-term OTEC needs for predictions of the complex near-field (1-3 km) effects of a single OTEC plant. An estimate for the aggregate effect of many OTEC plants on the horizontal thermohaline structure of the ocean is made in terms of the power density that would be required to sustain an induced, mesoscale anomaly against natural dissipation (as measured in a Gulf Stream eddy). Careful synthesis of the results of several models, in a spatial hierarchy from near-field to basin-wide scales, is required to provide reliable estimates of physical environmental impacts for OTEC purposes. (Sinha-OEIS)
W80-04197

PROGRESS REPORT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PROGRAM FOR THE 1-MWE EARLY OCEAN TEST PLATFORM,
Interstate Electronics Corp., Anaheim, CA. Oceanic Engineering Div.
M. D. Sands.
In: Proceedings of: Fifth Ocean Thermal Energy Conversion Conference, held Miami Beach, Florida, February 20-22, 1978, Cont - 780236 Lavi, A (ed.), p III-186-III-202, September 1978. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Thermal powerplants, Thermal pollution, Biota, Resources development, Gulf of Mexico, Hawaii, Puerto Rico, *Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Environmental impact assessment, Early Ocean Testing Platform.

The 1-MWe Ocean Thermal Energy Conversion Early Ocean Testing Platform (EOTP) has a projected test date in mid-1979 in the Gulf of Mexico, Hawaii, or Puerto Rico. This presentation summarizes the progress to date for the environmental impact assessment program for OTEC-1, the Early Ocean Testing Platform. The considerations in assessing impact for OTEC-1 first require a detailed description of the physical system design. Included in the design description are the depth of intake and discharge pipes, volumes discharged, and applicable safety regulations and procedures. The detailed site descriptive information including the biological, chemical, physical oceanographic and meteorological data must be gathered from all available sources. Particular study areas include the effects of impingement and entrainment, biocide effectiveness and toxicity to nontarget biota, working fluid release effects, climatological impacts, and worker safety. Also, the International, Federal, State, and local legal implications of siting will be considered. While socioeconomic impacts of OTEC-1 now appear to be minimal, there is potential later for substantial benefits to the resident community services. When all relevant data is at hand the predictive process for assessing environmental impact is underway. (Sinha-OEIS)
W80-04198

5D. Waste Treatment Processes

FUNCTIONAL POLYMERS FOR REMOVAL OF HEAVY-METAL POLLUTANTS FROM WATER,
West Virginia Univ., Morgantown. Water Research Inst.
A. Winston, D. G. Kirchner, and J. W. Rosthauser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158215, Price codes: A03 in paper copy, A01 in microfiche. Information Report 13, 1980. 38 p, 9 Fig, 14 Tab, 49 Ref, 1 Append. OWRT A-031-WVA(1), 14-34-0001-8052.

Descriptors: *Acid mine water, *Cation exchange, *Chelation, *Demineralization, *Heavy metals, *Iron, *Polymers, *Water treatment, Effluents, Heavy metal binding polymers, Industrial wastes, Ion exchange, Mine drainage, Mine water, Waste water treatment, Water pollution, Water treatment.

The project was to design polymeric ion-exchange resins specific for metal ions and particularly for systems for removing iron from water. The resins are vinyl polymers bearing hydroxamic acids and have strong affinity for iron. Polymers were prepared in which the spacing of the hydroxamic acids were varied. The stability constants of the iron complexes showed that the spacing of the hydroxamic acids was important both in complex stability and in the selectivity of the resin for iron. The polymer having the largest binding constant for iron had an 11-atom spacing between hydroxamic-acid groups. This polymer, prepared in an insoluble form, removed to less than 0.5 ppm iron from water. The polymer could be regenerated by washing with sodium hydrosulfite or EDTA. Copolymers bearing hydroxamic acid groups crosslink in the presence of iron, resulting in viscosity increases and flocculation. Polymers for binding copper and mercury were synthesized and evaluated. The functional group for copper was the tripeptide glycylglycylhistidine. For mercury, polymers containing sulfide were studied. Preliminary evaluation showed that the polymers formed complexes with copper and mercury. Various applications of these resins in environment, health, and industry are suggested.
W80-03911

INVENTORY AND EVALUATION OF ELEVATED SAND MOUND SEWAGE DISPOSAL SYSTEMS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
M. T. Hoover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158207, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, March 1979. 78 p, 5 Fig, 7 Tab, 50 Ref. OWRT B-098-PA(1), 14-31-001-7129.

Descriptors: *Sewage disposal, *Pennsylvania, Topsoil, Elevation, Berms, Construction, Soils, Design, Installation, Maintenance, Distribution, Water table, *Septic tanks, Effluent, *Waste water treatment, *Elevated sand mound system, Problem soils, Sandy fill, Malfunctions, Questionnaire, Sewage enforcement officer, Costs.

The elevated sand mound system, which is installed on the soil surface, has been used on problem soils in Pennsylvania since 1974. The purpose of this study was to ascertain the current state-of-the-art of elevated sand mound systems from an inventory of those systems in Pennsylvania, to determine how many were surface discharging, and to identify possible causes of these malfunctions. Questionnaires were sent to 705 sewage enforcement officers in Pennsylvania. Field trips were conducted to determine the rate and causes of surface discharge malfunctions. Most elevated sand mounds are located near densely populated areas and in areas where problem soils predominate. Questionnaire respondents indicated that over 5000 of these systems have been installed at an average cost of $2756. Forty-three percent of the systems in Pennsylvania are malfunctioning or have malfunctioned in the past, costing Pennsylvanians as much as six million dollars over a period of less than four years. The construction of berms was not found to prevent systems from surface discharging over slowly permeable soils. The presently used 10-cm diameter pipe is too large for adequate effluent distribution. Current regulations are inadequate to prevent surface discharge of the system. The design presently used is not flexible enough to accommodate the variety of soil conditions found in Pennsylvania.
W80-03912

RENOVATION OF SEPTIC TANK EFFLUENT IN SAND-CLAY MIXTURES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
B. P. Willman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158272, Price codes: A06 in paper copy, A01 in microfiche. Master of Science thesis, May 1979, 100 p, 12 Tab, 2 Fig, 31 Ref. OWRT B-098-PA(2), 14-31-0001-7129.

Descriptors: *Waste water disposal, Sands, Clays, Limestones, Shales, Coliforms, Chemical oxygen demand, Conductivity, Pathogenic bacteria, *Septic tanks, Ions, Materials, Particle size, *Effluents, Statistics, Sandstones, *Reclaimed water, *Rehabilation, *Waste water treatment, Sand mounds.

Research was conducted to determine if the clay material in a sandy fill significantly influences the renovation of septic tank effluent. Limestone, sandstone, and shale sands were used alone and combined with 3, 6, and 12 percent clay. Two natural sands also were used. Septic tank effluent was applied to the surface of 10-cm diameter plexiglass columns of all sands for 23 weeks. The effluent was analyzed at regular intervals for 16 chemical and biological variables before and after flowing through 60 cm of the sand. These variables were: pH, chemical oxygen demand, fecal coliforms, fecal streptococci, ammonium-nitrogen, total Kjeldahl nitrogen, nitrite-nitrogen, nitrate-nitrogen, nitrate-nitrite-nitrogen, orthophosphate, total phosphorus, chloride, calcium, sodium, potassium, and specific conductivity. All the sand-clay combinations removed over 99 percent of the fecal coliforms and streptococci. The removal of phosphorus and chemical oxygen demand, and the nitrogen transformations, were efficient in the limestone and shale sands regardless of clay content. The optimum pH for biological activity in the limestone sands rendered added renovating ability. The sandstone sand, a relatively inert material, was significantly influenced by clay content, particularly by the positive influence that the clay had on the pH. The results of the study indicate that limestone is the most desirable sand type, followed by sand-

stone with a small percentage of clay, and then by shale.
W80-03913

HYDRAULIC EVALUATION OF A MOUND SYSTEM IN MAINE,
Maine Univ. at Orono.
For primary bibliographic entry see Field 5B.
W80-03962

OPTIMIZED ECONOMIC USE OF SLUDGE TREATMENT FACILITIES IN DURBAN,
Durban City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 5B.
W80-03979

QUALITY AND TREATMENT OF WATER INVOLVED WITH COAL SLURRY TRANSPORT BY PIPELINE,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan, J. A. Godwin, and M. H. Shinn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160724, Price codes: A03 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri Completion Report, March 1980, 30 p, 14 Fig, 11 Ref. OWRT A-110-MO(2), 14-34-0001-9027.

Descriptors: *Coals, *Slurries, *Transportation, *Pipelines, Coal slurry pipelines, Heavy metals, Leaching, Humic acid, Water quality, Water treatment, Coal-water ratio, Water reuse, Lignite, Bituminous coal.

This document is a report of an investigation of the leaching of metals and organic matter from subbituminous coal and lignite under simulated coal slurry pipeline conditions. The leaching of metals present in the coals was investigated. These metals include iron, calcium, magnesium, aluminum, sodium, potassium, manganese, lead, copper, zinc, cobalt, nickel, chromium, and lithium. After leaching under slurry conditions for 24 hours, lead, cobalt, nickel, and chromium could not be detected in the water by flame atomic absorption. The percentages of the other metals extracted by water under slurry conditions ranged from 0.01 to 75%. The percentage of metal extracted varied widely with the type of metal and with the coal/water ratio in the slurry. Coal humic acids were extracted from coal in approximately 2% slurries and were readsorbed at coal percentages exceeding approximately 5%. These organic substances were shown to be involved in the solubilization of iron, copper, and aluminum.
W80-04108

EVALUATION OF MOUND SYSTEMS FOR PURIFICATION OF SEPTIC TANK EFFLUENT,
Wisconsin Univ.-Madison. Dept. of Soil Science.
C. J. Fitzgerald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158132, Price codes: A09 in paper copy, A01 in microfiche. M.S. Thesis, 1979. 310 p, 26 Fig, 18 Tab, 112 Ref. OWRT B-099-WIS(2), 14-34-0001-7200.

Descriptors: *Septic tanks, *Efficiencies, *Wisconsin, *Domestic wastes, *Sewage bacteria, Sewage disposal, Sewage treatment, Soil disposal fields, Water pollution source, Coliforms, Streptococcus, Pseudomonas, Viruses, Nutrient removal, Public health, Alternative septic systems, *Mound systems, Environmental sanitation, *Water purification.

Thirty-three mound systems for on-site disposal of septic tank effluent (STE) installed by commercial contractors in Wisconsin were surveyed and monitored for proper design, installation, operation, and wastewater purification. Every system examined was correctly sized and constructed but many systems were being dosed inappropriately with large volumes of STE. In these systems, bacteria and nutrients (N and P) from the STE penetrate deeper into the soil than in systems being properly dosed with more frequent smaller volumes of STE. However all systems removed bacteria, viruses and phosphorus effectively and reduced the N load passing through the soil by nitrification-denitrification. No evidence of contamination by bacteria, N or P could be found in high groundwater near 4 systems located over permeable soils. The pressure system used for STE distribution in Wisconsin mounds prevents the formation of biological crusts where the STE enters the soil, a phenomenon which leads to failure of conventional systems. Three cases of mound system failure reported in the state were due to faulty construction, not improper design or clogging. Wisconsin mound systems are expected to outlive and out perform conventional septic systems. (Harkin-Wis)
W80-04112

IMPACT OF WASTE DIVERSION ON WATER QUALITY IN LAKES,
Limno Tech, Inc., Ann Arbor, MI.
For primary bibliographic entry see Field 3C.
W80-04144

LEAST COST SOLUTIONS TO THE PROBLEM OF EFFLUENT ABATEMENT IN URBAN SYSTEMS,
Commerce and Business Administration, Vancouver (British Columbia).
P. N. Nemetz, and H. D. Drechsler.
Water Resources Bulletin, Vol 15, No 5, p 1374-1384, October 1979. 2 Fig, 5 Tab, 11 Ref.

Descriptors: *Systems analysis, *Municipal wastes, *Treatment facilities, *Cost analysis, *Optimization, *Pollution abatement, Economics, Sewage, Costs, Effluents, Marginal costs, Biochemical oxygen demand, Mathematical models, Sewage disposal, Sewage treatment, Alternative planning, Institutional constraints, Political aspects, Urban runoff, Treatment, Cost sharing.

A methodology identifies least-cost treatment systems for waterborne effluents generated within municipalities; the optimal solution entails an appropriate treatment distribution among all dischargers rather than sole reliance on centralized municipal treatment. Currently resources are misallocated because solutions are adopted without adequate evaluation of alternative treatment technologies, distributions of responsibilities for waste treatment and mechanisms for inducing compliance. One of the principal reasons for limited alternative search is the perverse incentives in the current institutional structure. The analysis is conducted in four steps: (1) construction of a systems materials balance; (2) assessment of estimated operating and capital costs of alternative sewage treatment levels; (3) identification of the optimal treatment solution; and (4) delineation and examination of several alternative implementation schemes. A hypothetical municipality with a population of 10,000 people is used. The source and deposition of biochemical oxygen demand is the principal focus; marginal cost curves are derived for different alternatives. Several implementation schemes mechanisms are available to local and regional governments once the optimal treatment solution is identified. Economic incentives could be employed to induce each a major polluter to treat wastes to the level desirable from a system-wide perspective. (Danovich-Wisconsin)
W80-04154

BENEFIT ANALYSIS FOR COMBINED SEWER OVERFLOW CONTROL.
EPA Technology Transfer Seminar Publication, EPA-625/4-79-013, April 1979. 54 p, 19 Fig, 8 Tab, 20 Ref.

Descriptors: *Cost-benefit analysis, *Combined sewers, *Combined sewer overflows, *Control, *Mathematical models, *Water pollution control, *Water quality control, Sewers, Overflow, Overflow control, Pollution sources, Stormwater models, Stormwater discharge, Stormwater, Technology, Sewage system, Collection system, Legislation.

Combined sewers are collection systems that combine both sanitary sewage and stormwater. They are typically found in older cities. Combined sewer overflows occur during or after storm events and their volumes and frequency are related to the rainfall patterns; they occur at discrete overflow points; and they contain the constituents found both in urban stormwater and in sanitary sewage. The result of an overflow can be significant discharge of organic material, nutrients, sediment, microorganisms, oil and grease, and metals and other potentially toxic substances into the receiving water. Benefit analysis is concerned with identifying the effects of overflows and the anticipated results of effecting change in them. There are two types of mathematical models useful in combined sewer overflow control planning--stormwater models and receiving water quality models. Stormwater models are tools to estimate or predict the volume of stormwater discharge and the loadings of its constituent pollutants. Receiving water quality models predict or simulate the effects of pollutant sources on the quality of the body of water into which they are discharged. Technologies to control pollution from combined sewer overflow can be grouped into three main categories: source controls to reduce the amount of pollutants entering the sewer system, collection system control to improve the system's effectiveness in storing and handling the flows, and off-line storage and treatment to remove pollutants from combined sewer flows. (Iervolino-NC)
W80-04165

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS: DESIGN FACTORS-I.
EPA Technology Transfer Seminar Publication, January 1976. 49 p, 3 Fig, 13 Tab, 37 Ref.

Descriptors: *Municipal wastes, *Waste disposal, *Waste water treatment, *Irrigation, *Land treatment, *Land application, *Design criteria, Wastes, Wastewater, Disposal, Sewage, Infiltration-percolation, Overland flow, Effluents, Sewage treatment, Sewage effluents, Land use, Design data.

Land application of wastewater or treated effluent involves the use of plants, the soil surface and the soil matrix for removal of certain wastewater constituents. The three basic methods of land application are irrigation, infiltration-percolation, and overland flow--irrigation being the predominant method in use today. Prior to land application, treatment of wastewater may be necessary in order to maintain a reliable distribution system, avoid nuisance conditions, maintain high infiltration rates, and so that the irrigated crops can be used for human consumption. The suitability of the land is judged by its location to the wastewater collection/treatment facilities; compatibility of planned objectives with overall land use plan; proximity to surface waters; and number and size of available land parcels. Other characteristics that should be considered are climate, topography, vegetation and geology and soils. For irrigation, land treatment distribution techniques can be classified into three main groups: fixed sprinkling systems, moving sprinkling systems and surface application systems. Comprehensive monitoring programs are required to ensure that proper renovation of wastewater is occurring and that environmental degradation is not occurring. (See also W80-04167) (Iervolino-NC)
W80-04166

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS: DESIGN FACTORS-II.
EPA Technology Transfer Seminar Publication, January 1976. 72 p, 22 Fig, 10 Tab, 42 Ref.

Descriptors: *Municipal wastes, *Waste disposal, *Waste water treatment, *Irrigation, *Land treatment, *Land application, *Design criteria, Wastes, Wastewater, Disposal, Sewage, High-rate irrigation, Overland flow, Infiltration-percolation, Effluents, Sewage treatment, Sewage effluents, Land use, Design data.

Land treatment or land application is the treatment of wastewater by using plant cover, soil surface, soil profile and geologic materials to remove cer-

tain wastewater pollutants. The main concern about this method is the possible harmful effects of the pollutants on the vegetation, soil and surface and groundwaters. Four possible processes successfully used are overland flow, irrigation, high-rate irrigation, and infiltration-percolation. Factors affecting site selection include soil, geology and groundwater, land use, sensitive environmental areas, water rights, the land application process, topography, and political boundaries and land ownership. For each process the effluent loading rate may be limited by the following constraints: infiltration capacity, soil permeability, soil and plant capacity to remove nitrogen and phosphorous, soil capacity to filter and assimilate suspended solids, soil capacity to remove and oxidize BOD and COD, soil capacity to remove and assimilate inorganic chemicals, discharge requirements to groundwater and surface water, and climatic influences such as precipitation, evapotranspiration and growing season. Components of land application systems include transport, preapplication treatment, storage, distribution, irrigation, surface drainage, subsurface drainage, buffer area and monitoring system. (See also W80-04166) (Iervolino-NC)
W80-04167

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS: CASE HISTORIES.
EPA Technology Transfer Seminar Publication, EPA-625/4-76-010, January 1976. 79 p, 13 Fig, 29 Tab, 36 Ref.

Descriptors: *Municipal wastes, *Waste disposal, *Waste water treatment, *Land treatment, *Sewage treatment, *Effluents, Wastes, Disposal, Treatment facilities, Irrigation, Infiltration, Wastewater reclamation.

In recent years, a number of experimental/operational systems have been designed to renovate wastewater by land application. This publication presents case histories of five properly managed systems of land application of municipal wastewater. The five facilities considered are: (1) the Michigan State University Water Quality Management Project (WQMP); (2) the City of Tallahassee Spray Irrigation Project (TSIP); (3) the Flushing Meadows Project (FMP); (4) the Pennsylvania State University Wastewater Renovation and Conservation Project (WRCP); and (5) the City of Boulder (CO) Project (BCP). Three of these were designed initially as pilot plants to provide alternative methods of wastewater removal from currently operating plants. The Michigan State University WQMP was designed exclusively as a research and development project to study alternative aquatic and terrestrial applications of wastewater to utilize the components as food for plants and animals. At Boulder, Colorado, the impetus for the BCP was that land treatment showed an economic advantage. Two of the programs--WQMP and WRCP--have seasonable variables that affect their operation, whereas year-round operation is possible at TSIP and FMP. The Flushing Meadows project pumps the water into infiltration basins from which it is rapidly absorbed into the soil instead of a spray irrigation system which the City of Tallahassee uses. The Pennsylvania State University WRCP was initiated to evaluate alternative methods of preventing further eutrophication of a stream that received effluent from a sewage treatment plant. (Iervolino-NC)
W80-04168

STATUS OF OXYGEN-ACTIVATED SLUDGE WASTEWATER TREATMENT.
EPA Technology Transfer Seminar Publication, EPA 625 4-77-003a, October 1977. 46 p, 17 Fig, 20 Tab, 6 Ref.

Descriptors: *Waste water treatment, *Oxygen-activated sludge treatment, *Water pollution treatment, *Sludge treatment, *Second Generation Open Reactor Oxygen System(MAROX), *Sewage effluents, Treatment, Sewage treatment, Waste water disposal, Water treatment, Wastes, Effluents.

The use of oxygen gas in the activated sludge process has evolved in the last eight years from a level of primarily academic interest to a point of broad application and implementation especially in North America and Japan. By 1980 it is projected that 150 oxygen systems will be in operation; as of June 1976 50 plants were in operation. Oxygen dissolution concepts include both covered and open reactor alternatives. Included in this study is a description of the second generation open reactor oxygen system (MAROX) for which there are two versions: one utilizing rotating active diffusers (RADs), the other fixed active diffusers (FADs). Presently the second generation RAD design appears to be a significant cost-effective improvement compared to the original FAD design. Evaluation of the MAROX system was done by the Metropolitan Denver (CO) Sewage Disposal District No. 1 funded by the U.S. Environmental Protection Agency. This document also summarizes the operating and performance data for 11 oxygen-activated sludge plants. Eight of the selected plants treat municipal wastewater and three are strictly industrial applications. The reactor designs for these plants represent a variety of configurations including both rectangular-stage systems and systems incorporating circular and acurate stages within larger self-contained circular tanks. (Iervolino-NC)
W80-04170

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--ANALYSIS OF CONCLUSIONS: SUMMARY OF FINDINGS AND RECOMMENDATIONS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04171

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. I.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04173

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. II.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04174

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. III.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04175

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. IV.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04176

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX B. IMPACT STUDIES.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04177

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX C. ANALYSIS OF INSTITUTIONAL ARRANGEMENTS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04178

UTILIZATION OF NATURAL ECOSYSTEMS FOR WASTEWATER RENOVATION,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, D. L. King, R. C. Ball, and T. G. Bahr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-100431, Price codes: A08 in paper copy, A01 in microfiche. Report EPA-905/3-79-003 prepared for Region V, Great Lakes National Program Office, U.S. Environmental Protection Agency, Chicago, April 1979. 155 p, 50 Fig, 6 Ref. 4005065.

Descriptors: *Water renovation, *Wastewater treatment, *Experimental facilities, *Municipal wastes, *Sewage treatment, *East Lansing(MI), *Ecosystems, Effluents, Sewage effluents, Waste water reclamation, Water reuse, Transmission lines, Phosphorus, Lakes, Biomass, Nitrogen, Forage crops, Land treatment, Irrigation.

This study describes the uses for a permanent facility constructed in the vicinity of the City of East Lansing, MI for the experimental recycling, treatment, and reuse of municipal sewage effluent on a 500 acre site on the campus of Michigan State University. The facility provides for diversion of up to 7570 cubic m/day of secondary effluent from the East Lansing activated sludge treatment plant. This waste flow is directed away from the receiving stream to an intensely managed aquatic and terrestrial nutrient recycling system. The facility consists of a portion of the wastewater treatment plant, a transmission line, a lake system of four experimental lakes, and a spray irrigation system. The four lakes used were found to significantly decrease effluent phosphorus load, nitrogen, alkalinity, and coliform bacteria. Forage crops were highly efficient in the uptake of nitrogen and phosphorus from wastewater and have the potential of renovating up to 7.5 cm/week of wastewater. Recommendations included spraying all water effluent on irrigated land and discharging none into the lakes, establishment of better biomass baseline data, managing the lakes so that nitrogen is stripped from incoming wastewater, and avoiding spraying high nitrogen wastewater in older forests since removal efficiency is low. Continued research needs are set out. (Arnold-NC)
W80-04188

5E. Ultimate Disposal Of Wastes

SOIL SUITABILITY FOR ON-SITE WASTE DISPOSAL: DEVELOPMENT OF GENETICALLY MARKED ESCHERICHIA COLI STRAINS AS TRACERS OF SUBSURFACE WATER FLOW,
Oregon State Univ., Corvallis. Water Resources Research Inst.
C. Hagedorn, and E. L. McCoy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160369, Price codes: A05 in paper copy, A01 in microfiche. Completion Report WRRI-65, November 1979. 81 p, 12 Fig, 6 Tab, 132 Ref. OWRT A-039-ORE(2).

Descriptors: *Subsurface flow, *Waste disposal, *Tracers, *Soil properties, Permeability, *Septic tanks, Effluents, *Path of pollutants, Bacteria, Saturated soils, Oregon, *Escherichia coli, Willamette Valley area(Oregon).

This study was undertaken to determine whether or not public health hazards could be created when septic-tank drainfield trenches became submerged under seasonal perched water tables on hillslope soils adjacent to the Willamette Valley, Oregon. The research results indicated that such hazards can occur when fecal bacteria are displaced under saturated flow conditions and transported downslope with resulting water contamination. The major research findings include: (1) Fecal organisms were transported, via saturated subsurface flow, for longer distances and over shorter periods of time than was expected or previously reported, (2) Antibiotic-resistant strains of Escherichia coli were found to be suitable as tracers of subsurface water flow through saturated soil profiles in western Oregon, (3) Fitting the data to dispersion equations indicated that dilution and dispersion were the major parameters controlling bacterial translocation under saturated conditions. Adsorption and filtration were minor considerations as long as soil

saturation was maintained, (4) Different organisms (bacteria and viruses) were transported through the saturated soils at rates equivalent to the speed of water flow. At this level the size of the particles which were transported was not a factor in the dynamics of subsurface translocation.
W80-04017

5F. Water Treatment and Quality Alteration

DEMINERALIZATION OF BRACKISH MUNICIPAL WATER SUPPLIES--COMPARATIVE COSTS,
Miller and Associates, Boulder, CO.
For primary bibliographic entry see Field 6B.
W80-03978

IMMUNE RESPONSE TO BACTERIAL IMMUNIZATION OF CHANNEL CATFISH MAINTAINED IN A RECIRCULATING WATER-REUSE SYSTEM,
Memphis State Univ., TN.
For primary bibliographic entry see Field 5C.
W80-04016

SELECTION AND USE OF POLYMERS IN CONTACT FILTRATION,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
M. M. Ghosh, and H. H. Yeh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160351, Price codes: A07 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, February 1980. 134 p, 53 Fig, 11 Tab, 41 Ref. OWRT A-107-MO(1), 14-34-0001-8027 and 9027.

Descriptors: *Water treatment, *Filtration, *Polymers, Dosage selection, Cation exchange, Velocity gradient, Head loss, Floc breakup, High shear, *Turbidity removal, *Polyelectrolytes.

Laboratory investigations were carried out to determine the type and dosages of polymers best suited for direct filtration. Viscosity and conductivity measurements were found to be unreliable methods for determining dosages. Low to medium weight cationic polymers (M.W.= 1 x 10 to the fourth power to 1 x 10 to the fifth power) were found to be ideally suited for the direct filtration of low turbidity waters. The principal mode of interaction was adsorption and charge neutralization for these polymers. The best method of determining dosage was the jar test, using rapid mixing only at high liquid shear, followed by particle size analysis. For high molecular weight polymers bridging appears to be the primary mechanism of polymer action. Standard jar tests do not provide the high G's necessary to obtain the optimum mixing of polymers. Specifically, a maximum G of 300 sec-1 was required during rapid mixing of polymers with molecular weight in the neighborhood of 5x10 to the fourth power. The duration of mixing may vary from 3 to 8 minutes depending on the molecular weight, with large molecular weight polymers requiring less time, presumably because of fast adsorption and bridging. The ccc and the optimum dosages for flocculation were exponentially correlated with the charge density per molecule of the polymer. In filtration, flocs captured within the pores are liable to be subjected to high shear as the bed becomes clogged. This may cause breakup and dislodgement of predeposited flocs, which ultimately would breakthrough, much the same way desorption of solutes occur. For optimum filtering conditions, breakup occurred when G in the clogged bed exceeded 700 sec-1. The particle size distribution data clearly demonstrated the in situ flocculation within the filter bed, followed by breakage when G became large due to clogging.
W80-04018

POSSIBLE RELATION BETWEEN PHYTOPLANKTON NUMBERS AND SAPROLEGNIOID FUNGI IN SHATT AL-ARAB NEAR BASRAH, IRAQ,
Basrah Univ., Al Basrah (Iraq). Dept. of Biology.
H. A. Al-Saadi, S. S. Rattan, T. W. Muhsin, and H. A. Hameed.
Hydrobiologia, Vol 63, No 1, p 57-62, March 1979. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Iraq, *Shatt Al-Arab River(Iraq), *Fungi, *Phytoplankton, *Correlation analysis, Seasonal, Hydrogen ion concentration, Dissolved oxygen, Salinity, Biological communities, Growth rates, Diatoms, Speciation, Benthic flora, Algae, Population, Decomposing organic matter, Biodegradation, Water temperature.

Phytoplankton numbers correlate negatively with decomposing fungi, Saprolegniaceae, in Shatt Al-Arab River near Basrah, Iraq as measured September 1976-August 1977. During peak phytoplankton growth periods, fungi occurrence is minimal and during minimum phytoplankton growth periods, fungi are abundant. This relationship is significant throughout the year except in July-August when both phytoplankton and fungi numbers decrease due to unfavorable high temperatures. Fungi depend on phytoplankton as substrate which becomes available after phytoplankton decline and decay. Saprolegnioid fungi seasonal variation is independent of pH, salinity and dissolved oxygen. pH range fluctuates 7.0-8.0, salinity 0.74-1.04 ppt. Dissolved oxygen is usually saturated although it varies with temperature. However, fungi abundance significantly correlates with temperature. Phytoplankton maxima occur in October-November, March and June. Populations are dominated by benthic forms and dominant species are diatoms especially pinnate diatoms (74.76%). Green and blue-green algae are only 10.28% and 14.01%, respectively. Cyclotella meneghiniana dominates. Fungi maxima occur in January, April and September. Of 10 species, four belong to Saprolegnia, five to Achlya and one to Dictyuchus. (Danovich-Wisconsin)
W80-04119

PHOSPHATASE ACTIVITY AND ITS ROLE IN THE MINERALIZATION OF ORGANIC PHOSPHORUS IN COASTAL SEA WATER,
Tokyo Univ. (Japan). Ocean Research Inst.
H. Kobori, and N. Taga.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 1, p 23-39, January 1979. 8 Fig, 3 Tab, 30 Ref.

Descriptors: *Cycling nutrients, *Phosphorus, *Bays, *Japan, *Bacteria, *Enzymes, Decomposing organic matter, Coasts, Biomass, Heterotrophy, Phytoplankton, Organic compounds, Biodegradation, Inorganic compounds, Degradation(Decomposition), Water chemistry, Biochemistry, Sea water, Primary productivity, Marine bacteria, Tokyo Bay(Japan), Sagami Bay(Japan), Suruga Bay(Japan).

Investigations of the role of phosphatase in mineralizing natural organic phosphorus in eutrophic Tokyo Bay and less eutrophic Sagami and Suruga Bays, Japan coastal waters, July 1973 and August 1977, demonstrate that phosphatase enzymes play a significant role in phosphorus regeneration in Tokyo Bay and especially in Sagami Bay. Alkaline phosphatase in Tokyo Bay is associated with bacterial biomass and closely parallels heterotrophic bacteria counts. Phosphatase activity also correlates with chlorophyll-a concentrations; therefore, bacteria and phytoplankton make major contributions to phosphatase production in Tokyo Bay. Organic phosphorus accounts for 48% of total phosphorus in Tokyo Bay (0-20 m) and 87% and 98% in surface waters (0-20 m) in Sagami and Suruga Bays, respectively. Phosphatase-hydrolysable organic phosphorus makes up 19% of organic phosphorus in the Tokyo Bay water column and 50% in Sagami Bay euphotic zone. In euphotic zones, phosphatase-hydrolysable organic phosphorus decomposes completely, suggesting that this organic fraction is recycled by primary production. Inorganic phosphorus released by phosphatase action makes up less than 10% of inorganic phosphorus present in Tokyo Bay and 67% in Sagami Bay. Therefore, phosphatase-hydrolysable organic phosphorus plays an important role as an inorganic phosphorus source in Sagami Bay. (Danovich-Wisconsin)
W80-04141

CAPITAL COST FUNCTIONS OF A SURFACE WATER TREATMENT PLANT AND ITS COMPONENTS,
Illinois Univ. at Urbana-Champaign. Coll. of Commerce and Business Administration.
For primary bibliographic entry see Field 6C.
W80-04161

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--ANALYSIS OF CONCLUSIONS: SUMMARY OF FINDINGS AND RECOMMENDATIONS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04171

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. I.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04173

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. II.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04174

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. III.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04175

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. IV.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04176

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX B. IMPACT STUDIES.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04177

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. SUPPLEMENT TO APPENDIX C. IMPLEMENTING A LAND-BASED SYSTEM--AN ANALYSIS OF APPROACHES.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04179

5G. Water Quality Control

INCORPORATION OF PERCEPTUAL STANDARDS INTO A WATER QUALITY INFORMATION SYSTEM,
Auburn Univ., AL. Dept. of Accounting and Finance.
For primary bibliographic entry see Field 6A.
W80-03966

MULTIOBJECTIVE OPTIMIZATION IN WATER QUALITY AND LAND MANAGEMENT,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W80-04027

POST-WAR LAND DRAINAGE, FERTILIZER USE AND ENVIRONMENTAL IMPACT IN NORTHERN IRELAND,

New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
For primary bibliographic entry see Field 4A.
W80-04115

KEEP RECREATIONAL WATERS ALGAE-FREE,
CH2M/Hill, Inc., Denver, CO.
J. J. Ahern, and B. L. Weand.
Water and Wastes Engineering, Vol 16, No 10, p 14-18, October 1979. 3 Fig.

Descriptors: *Detention reservoirs, *Flaming Gorge Reservoir(UT), *Recreation, *Aquatic weed control, *Eutrophication, Impoundments, Water pollution control, Water pollution sources, Water pollution effects, Nonpoint source pollution, Point source pollution, Phosphorus, Water skiing, Water sports, Erosion, Utah, Fishing, Swimming, Reservoirs.

Flaming Gorge was created in 1962 by damming the flow of the Green River in northeastern Utah. The reservoir watershed covers approximately 10,000 sq miles, and was built for two purposes: (1) Storage of water for irrigation, power generation, and municipal and industrial water supplies; (2) Water-based recreational opportunities such as swimming, fishing, boating. Eutrophication has been accelerated in Flaming Gorge Reservoir through human interference, and has produced negative effects on recreational opportunities. Algal mats, a side product of eutrophication, have been interfering with boating and swimming. The trout population decreased from 84% of the total fish population in 1964 to 9% in 1969, while non-game fish populations have correspondingly increased. The main cause of the accelerated eutrophication is high phosphorus levels. The phosphorus contribution from point and nonpoint sources is estimated at 575 tons/year, with natural and man-made erosion contributing the highest phosphorus percentage (87%), followed by municipal wastewater discharges (11%), and urban and septic tank runoff (2%). To maintain phosphorus concentrations within permissible levels would require an 80% reduction in the present phosphorus loading. However, natural erosion, the main phosphorus contributing factor may not be controllable. (Harris-Wisconsin)
W80-04116

PLANNING FOR NONPOINT POLLUTION CONTROL IN NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 5B.
W80-04130

IMPACT OF WASTE DIVERSION ON WATER QUALITY IN LAKES,
Limno Tech, Inc., Ann Arbor, MI.
For primary bibliographic entry see Field 3C.
W80-04144

GROWTH AND POPULATION STUDIES ON TILAPIA GALILAEA IN LAKE KINNERET,
Israel Oceanographic and Limnological Research Ltd., Haifa.
R. Landau.
Freshwater Biology, Vol 9, No 1, p 23-32, February 1979. 1 Fig, 6 Tab, 25 Ref.

Descriptors: *Algal control, *Eutrophication, *Population, *Fish populations, *Lake Kinneret(Israel), Tilapia galilaea, Peridinium cinctum, Aquatic productivity, Nuisance algae, Water quality control, Fish establishment, Fish harvest, Fish farming, Fish reproduction, Life cycles, Growth rates, Life history studies, *Israel.

This study assessing stock size of endemic cichlid fish Tilapia galilaea in Lake Kinneret, Israel is prompted by earlier suggestions that water quality in this otherwise-unpolluted lake be maintained by using the fish to control algal blooms. Because the fish feeds selectively on bloom organism, Peridinium cinctum, the fish is considered useful in controlling the algae if enough fish population are maintained through stocking. It is suggested that recruitment of stocked fish can be increased by introduction in December and by use of fingerlings which can grow to marketable size in less than two seasons. Between 1967-1977 catches of this commercially taken fish dropped from an annual average of 200 t to 70 t, then increased to their original level. Assuming a natural mortality of 0.94, total stock size averaged 300-700 t during 1970-1976, while recruitment averaged 0.7-3 million/yr. Three broods hatched during relatively high water levels 1970-1972 yielded especially low recruitment. The Von Bertalanffy growth coefficient is estimated at 0.67 and final length at 25-36 cm. First year growth, 23-152 cm, is closely related to final length which in turn is affected by genetic variations in the total population. Changes in proportions of fast-growing and slow-growing fish cause yearly fluctuations in size distribution. Recruitment to the fishery, at 17-20 cm, occurs between 1+ and 3+ years of age. Highest growth rates for year-old fish, 1-2% mean wt/day, occurs April-May, the Peridinium season. During July only a small proportion of year-old fish reach marketable size, because of a diminishing food supply. (Harris-Wisconsin)
W80-04152

A CHANCE-CONSTRAINED GOAL PROGRAMMING MODEL TO EVALUATE RESPONSE RESOURCES FOR MARINE POLLUTION DISASTERS,
Texas Univ. at Austin. Center for Cybernetic Studies.
For primary bibliographic entry see Field 6A.
W80-04164

BENEFIT ANALYSIS FOR COMBINED SEWER OVERFLOW CONTROL.
For primary bibliographic entry see Field 5D.
W80-04165

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS: DESIGN FACTORS-I.
For primary bibliographic entry see Field 5D.
W80-04166

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--ANALYSIS OF CONCLUSIONS: SUMMARY OF FINDINGS AND RECOMMENDATIONS.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 851, Price codes: A03 in paper copy, A01 in microfiche. April 1973. 30 p, 5 Fig, 26 Tab.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water quality, Economics, Social aspects, Water pollution, Water use, Comprehensive planning, Pennsylvania, Primary treatment, Secondary treatment, Tertiary treatment, Alternative planning, Water reuse.

This is a summary of the findings and recommendations of the District Engineer for the wastewater management system study for the Codorus Creek Basin, a 280 square mile portion of the Susquehanna River Basin in Southeastern Pennsylvania. The Codorus stream system is severely degraded. The District Engineer's specific recommendations include adoption of one of three of the six alternative plans--the December Plan, the Basic All Land Plan, or the Basic All Water Plan; establishment of a county wastewater management authority to carry out detailed planning for and supervision of implementation of the selected plan, and to pursue industrial reuse of wastewater effluents; development of a stormwater management plan; and immediate implementation of the selected plan. The report outlines the problems, study objectives and methodology. The six alternative plans are described: the Plan to Meet Current Standards, the December Plan, the Basic and Modified All Water Plans, and the Basic and Modified All Land Plans. A reuse option would be applicable to any of these plans. The Summary of Findings includes proposals for ways for these plans to meet requirements of the Federal Water Pollution Control Act Amendments, P.L. 92-500, as well as a discussion of environmental, social, and economic impacts of each alternative plan. The effects of each of the alternative plans are organized in terms of 'premise sets' to facilitate choice among the plans, focusing on four of the plans. (Arnold-NC)
W80-04171

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. I.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 853, Price codes: A04 in paper copy, A01 in microfiche. August 1972. 70 p, 27 Exhibits.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water pollution, *Water supply, *Water quality control, *Water quality, Economics, Social aspects, Water use, Comprehensive planning, Pennsylvania.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. This appendix defines the study area. Current demographic and economic conditions are outlined, including present population distribution and the levels of area economic activity. Geophysical resources discussed include the basin's geology, hydrogeology, soils, and hydrology. Surface water supply management systems and their development are examined, and present wastewater management systems are described including municipal, manufacturing-commercial, and private systems; irrigation with wastewater; waste loadings; stormwater and combined sewer effects; and management of sludge solids. Water quality conditions are discussed and analyzed. Physical, chemical and biological conditions are described and the principal water quality problems are identified. A summary of existing water quality conditions is included. (Arnold-NC)
W80-04173

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. II.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 854, Price codes: A03 in paper copy, A01 in microfiche. August 1972. 47 p, 19 Exhibits.

Descriptors: *Water resources planning, *Waste water treatment, *Water management, *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water quality control, *Water quality, Economics, Social aspects, Water use, Water demand, Comprehensive planning, Pennsylvania, Primary treatment, Secondary treatment, Tertiary treatment, Industry, Projections, Economics.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. The purpose of this appendix is to identify and evaluate future water resource-wastewater management needs based on assessments of future area growth and environmental management objectives. Demographic and economic growth trends are presented for the area. Population forecasts are made through the year 2020; population is expected to double from 1970 to 2020. Wastewater flow projections are made for

domestic wastewater and manufacturing and commercial wastewater systems. These systems are expected to change in mix from 50%-50% in 1970 to 70% domestic-30% manufacturing-commercial by the year 2000. Future water supply demand on the area's system will depend upon the future mix of domestic and manufacturing-commercial uses as well as upon the availability of supplies for those uses. Water quality management objectives for the area are discussed. Water quality criteria for streams are presented. Existing management action includes a pollution abatement implementation plan. The long-range effects of the plan are summarized and water nutrient reduction relationships are discussed. Further removal of nitrogen and phosphorous is necessary to obtain water quality conditions satisfactory for multiple use objectives. Nitrogen reduction should be 90% or greater, and phosphorous reduction, 95-98%. (Arnold-NC)
W80-04174

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. III.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 855, Price codes: A10 in paper copy, A01 in microfiche. August 1972. 208 p, 17 Fig, 52 Tab, 20 Exhibits, 30 Ref.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water pollution, *Water quality, *Land treatment, Economics, Social aspects, Water use, Comprehensive planning, Pennsylvania, Cost analysis, Management alternatives, Treatment facilities, Water reuse, Sludge disposal, Costs.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. This appendix investigates wastewater management for industrial and municipal discharges to the Codorus Creek Basin. Wastewater flow projections were developed for each of the 16 service areas for the years 1980, 1990, 2000 and 2020. Total wastewater flows are projected to increase 165% in the year 2000 over current levels. Water quality management objectives are presented for the study area in terms of water quality stream standards, existing action plans, and water quality performance criteria. Technological alternatives for wastewater system design are examined. The basic technologies available to meet long-range objectives encompass advanced water process treatment and land treatment through irrigation. Performance capabilities of these systems are evaluated for cost and performance relationships relative to present and long-range water quality management objectives. Physical characteristics are examined for suitability for wastewater applications. Water reuse is examined as an alternative for conservation of available water supplies and maintenance or enhancement of stream flows. Five of the most promising wastewater system management alternatives are analyzed and cost evaluations presented for each alternative. (Arnold-NC)
W80-04175

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY--APPENDIX A. TECHNICAL STUDIES. VOL. IV.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 856, Price codes: A12 in paper copy, A01 in microfiche. August 1972. 266 p, 7 Fig, 57 Tab, 35 Exhibits.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water reuse, *Land treatment, Economics, Social aspects, Water quality, Water use, Comprehensive planning, Pennsylvania, Primary treatment, Secondary treatment, Tertiary treatment, Stormwater management, Treatment facilities, System design, Sludge disposal, Costs, Maintenance costs, Operating costs.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. Analysis of wastewater management problems and possible solutions led to formulation and analysis of a broad range of technology and design alternatives. These encompassed a range of specific solutions advocated for the area and basic technology choices for achieving high wastewater management standards, alternative levels of performance capability and a broad range of constitutional management choices. This appendix considers five specific alternative plans: (1) Plan to Meet Current Standards; (2) All Water Treatment Plan; (3) All Land Treatment Plan; (4) December Plan--a combination of the All Water and All Land Plans; and (5) Reuse Plans. Facilities plans and projected costs are presented for each plan. Sludge management and industrial wastes management plans are also presented. Three options are discussed for the Reuse Plan. A Stormwater Management Plan is presented for the Basin including operation and maintenance costs for the plan. (Cooper-NC)
W80-04176

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX B. IMPACT STUDIES.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 857, Price codes: A08 in paper copy, A01 in microfiche. August 1972. 164 p, 16 Fig, 14 Tab, 98 Ref.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water quality, Economics, Social aspects, Water use, Comprehensive planning, Pennsylvania, Aquatic ecology, Terrestrial ecology, Public health, Benthic organisms, Social impacts, Economic impacts, Environmental impacts.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. This appendix describes the assessment and evaluation of impacts of several alternative wastewater management plans for the Basin. The four basic plans were (1) a decentralized water-oriented system, (2) a centralized water-oriented system, (3) a combination water-land system, and (4) an industrial reuse water-land system. Six impact areas were selected: economic, social, aquatic ecology, terrestrial ecology, visual, and public health risk. Within the economic and social impact areas, short- and long-term economic stimulation, employment, housing and public service, leisure opportunities, agriculture, land use, land values and visual (direct and indirect) impacts were considered. All four plans would have positive effects on short- and long-term economic stimulation, employment, leisure opportunities, and aquatic ecology. Plans (3) and (4) would have negative effects on housing and public service, land values and direct visual impacts. All four alternatives would greatly enhance the indirect visual-resultant water quality attributes of the Creek. Aquatic ecology would be enhanced, with a decrease in potential eutrophication. Terrestrial ecology impacts would be positive; management of interceptor rights-of-way could be handled to provide low level vegetation for small game habitats. All alternatives should reduce microbial contamination but land disposal might have adverse public health effects. (Cooper-NC)
W80-04177

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX C. ANALYSIS OF INSTITUTIONAL ARRANGEMENTS.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 858, Price codes: A03 in paper copy, A01 in microfiche. August 1972. 45 p, 5 Fig, 3 Tab, 4 Attachments.

Descriptors: *Water resources planning, *Wastewater treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water quality, Economics, Social aspects, Water pollution, Water use, Comprehensive planning, Governments, Institutional arrangements, Legal aspects, Financial aspects.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. This appendix presents an overview of the interrelationship of various agencies which will be involved in implementing and managing any given wastewater treatment alternatives in the Basin. There are currently 14 existing wastewater management authorities in the study area. Some kind of unifying institution would have to be established to provide centralized leadership for basin-wide action on wastewater. Legal analysis for expanding present or developing new institutions is presented. This analysis discusses municipal powers for construction and operation of wastewater treatment facilities, including the formation of water authorities and land acquisition powers. Four institutional alternatives are presented, along with probable impacts, ranging from total decentralization to complete centralization; these alternatives are discussed within existing and pending legislation. Potential sources of financial assistance are examined, including Federal, state and local programs. Conclusions indicate that the most attractive institutional arrangement for wastewater management in the Basin would be a County Wastewater Authority. (Arnold-NC)
W80-04178

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. SUPPLEMENT TO APPENDIX C. IMPLEMENTING A LAND-BASED SYSTEM--AN ANALYSIS OF APPROACHES.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 859, Price codes: A02 in paper copy, A01 in microfiche. August 1972. 24 p, 8 Tab.

Descriptors: *Water resources planning, *Waste water treatment, *Water management(Applied), *Water pollution control, *Economic analysis, *Codorus Creek(PA), *Water quality, Economics, Social aspects, Wastewater irrigation, Water pollution, Water use, Comprehensive planning, Pennsylvania, Land management, Land treatment.

The Codorus Creek Wastewater Management study was undertaken to recommend actions necessary to improve significantly the water quality of the creek in order to provide a basis for restoration of natural environmental values and enhancement of the economic and social needs of the people. The Codorus stream system, which is severely degraded, covers 280 square miles in southern Pennsylvania. This volume provides additional information with regard to implementing a land-based wastewater management system in the Basin. Alternatives for land acquisition and management are discussed and action proposals are made involving individual and joint municipal efforts, formation of a municipal authority, or contracting with a private corporation for development of the

system. Land-spreading alternatives for wastewater in York County are examined in relation to existing farm size, ownership, and farm operator information. A particular area, Census Tract 217, is mentioned as a candidate for irrigation of treated wastewaters. Various potential management concepts are outlined to meet stated goals of minimizing human relocation due to plant construction, maintaining or improving the local tax base, stabilizing rural community values, and increasing on-farm income by land spreading. (Arnold-NC)
W80-04179

WATER QUALITY AND MINING: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
December 1979. 59 p, 8 Fig, 4 Tab, 24 Ref.

Descriptors: *Water quality, *Mining, *North Carolina, *North Carolina Mining Act of 1971, *Sedimentation, *Mine wastes, *Sedimentation control, *Water pollution sources, Mines, Water management(Applied), Planning, National Pollutant Discharge Elimination System, Pollutants, Pollution, Erosion, Waste disposal, Pollution control, Nonpoint source pollution.

This document is an assessment of mining practices in North Carolina and their effects on water quality. Of the 507 mines in the State that affected more than 11,695 acres of land in 1978, all but one produced non-metallic minerals and no coal mining was undertaken. The control and treatment of point source discharges from mining operations has been greatly improved through the National Pollution Discharge Elimination System and the State's Mining Act of 1971. Potential adverse effects of mine operations include acid drainage, drastic landscape alteration, displacement of wildlife and soil erosion resulting in offsite sedimentation. In North Carolina mining, the potential adverse effect of the most widespread concern is offsite sedimentation of inorganic solids. The primary objective of the mining program in the State is to assure the reclamation of areas disturbed by mining within two years after the completion of mining. Best management practices for mining include use of vegetation, diversions, erosion control on haul roads, erosion control on spoil piles and tailings, buffer strips, seasonal restrictions, erosion control at abandoned mine sites, and silt fences. (Iervolino-NC)
W80-04180

IMPACT OF NONPOINT POLLUTION CONTROL ON WESTERN LAKE SUPERIOR, RED CLAY PROJECT, FINAL REPORT: SUMMARY,
Environmental Protection Agency, Chicago. IL. Great Lakes National Program Office.
For primary bibliographic entry see Field 2J.
W80-04181

INTERACTIVE POLLUTANTS AND JOINT ABATEMENT COSTS: ACHIEVING WATER QUALITY STANDARDS WITH EFFLUENT CHARGES,
Newcastle-upon-Tyne Univ. (England). Dept. of Economics.
B. Beavis, and M. Walker.
Journal of Environmental Economics and Management, Vol 6, No 4, p 275-286, December 1979. 2 Fig, 13 Ref.

Descriptors: *Water pollution control, *Interactive pollutants, *Joint abatement costs, *Water quality, *Effluent charges, *Analysis, *Water quality control, Abatement, Pricing policy, Taxes, Pollution abatement, Model studies, Hydrologic models, Control, Water pollution abatement.

The authors study water pollution control by considering simultaneously spatial considerations, interactive pollutants, and joint abatement costs. Analysis is confined to pollutants which exert either an acute toxicity effect or a dissolved oxygen demand or both. Two forms of environmental constraint are specified. One, designed to deal with non-interacting pollutants, places upper bounds on the allowable levels of concentrations of certain pollutants in a given stretch of the water course. The second set of constraints is designed to handle explicitly the case of interactive pollutants. Satisfactory resolution of water pollution control problems requires that discharges of pollutants at any point in the water course be related to ambient concentrations of toxicity and dissolved oxygen in each stretch of the water course. Hydrological modeling techniques have demonstrated the possibility of making predictions of this kind. The analysis in this paper raises serious doubts about the practicability of an iterative pricing policy taking place in real time for determining the appropriate tax to be levied on polluting discharges in order to achieve specified levels of water quality. (Iervolino-NC)
W80-04187

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE DEVELOPMENT OF PALIS: A PONDS AND LAKES INFORMATION SYSTEM FOR MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. J. Godfrey, S. A. Joyner, Jr., E. L. Goldstein, and L. Ross.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-156979, Price codes: A12 in paper copy, A01 in microfiche. Publication No 108, 1979. 236 p, 10 Fig, 3 Tab, 26 Ref, 22 Append. OWRT A-124-MASS(1), 14-34-0001-9023.

Descriptors: *Management information systems, *Data storage and retrieval, *Information retrieval, *Ponds, *Lakes, Electronic data processing, Automatic data processing, Water management(Administrative), Water management(Applied), Water resources planning, Computer programs.

The present study deals with the design of a state-of-the-art information system for managing ponds and lakes resources at the state level. Accomplishing this goal for Massachusetts entailed the completion of 4 separate tasks: (1) To assess the quality and quantity of ponds and lakes information existing in Massachusetts. (2) To survey the 'state of the art' of computerized management information systems including water resources information systems. (3) To evaluate the implications for Massachusetts state agencies of computerizing in a single system all the ponds and lakes information they already possess. (These implications involved the assessment of how the agencies' current ponds and lakes management decisions depended on ponds and lakes data, and how these decisions--and the data they depend on--could be expected to change in response to federal programs.) (4) To design a management information system for Massachusetts ponds and lakes information. This design included the creation of a complex data base structure which was suited to existing computer software packages, and the development of a functioning pilot demonstration system based on state agency data for 20 lakes and ponds. To our knowledge the Massachusetts Ponds and Lakes Information System (PALIS) is the first comprehensive statewide computerized information system for the management of ponds and lakes resources. The need it is designed to fill in Massachusetts exists in other states as well, and both the PALIS design process and the PALIS system are readily transferable to other states seeking to improve the management of their ponds and lakes resources.
W80-03902

GROUNDWATER BASIN MODELING USING THE FINITE ELEMENT METHOD - YOLO COUNTY CASE STUDY,
California Univ., Davis, Dept. of Agricultural Economics.
O. A. Bamgboye.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-157 324, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, 1979, 126 p, 20 Fig, 6 Tab, 2 Append. (California Water Resources Center Project UCAL-WRC-W-526). OWRT-B-187-CAL(1).

Descriptors: *Groundwater, *Water management(Applied), *Finite element analysis, Analytical techniques, Algorithm, California, Aquifer management, Model studies, *Yolo County(Calif).

In order to effectively monitor and manage aquifers subjected to varying natural and artificial recharge as well as increased pumping demands, it becomes necessary to analyze their hydrodynamic response. In this study a regional two-dimensional flow analysis is formulated using finite element techniques. A general algorithm is described to handle confined or unconfined flow. The advantage of using finite element analysis for aquifer flows becomes evident when attempting to model irregular boundaries and variable inputs such as natural recharge, pumping and aquifer properties. Numerical solutions are presented which, when compared with known analytical results, verified the technique and showed some limitations of the model. An analysis is presented of flow in the aquifer systems underlying Yolo County, a region where time variable pumping and natural recharge do occur. Unconfined and confined groundwater flow analysis were employed to simulate the hydrodynamic response of the Yolo County aquifer systems. The Galerkin time step scheme formulation was found applicable for small time steps. Based on minimization of differences between recorded and computed groundwater levels, the confined analysis using reliable constant transmissivity values is regarded as the most appropriate model for the aquifer systems. (Snyder-Calif)
W80-03904

OPTIMAL ALLOCATION OF WATER RESOURCES IN AN INPUT-OUTPUT FRAMEWORK: USER'S MANUAL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
T. Jonch-Clausen, and H. J. Morel-Seytoux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-158264, Price codes: A12 in paper copy, A01 in microfiche. Interim Report for FY 1977-1978, Report No CER 77-78TJ - HJM 23. March 1978, 259 p, 22 Fig, 17 Tab, 24 Ref, 3 Append. OWRT B-115-COLO (5).

Descriptors: *Water allocation(Policy), *Planning, *Input-output analysis, *Computer models, Mathematical models, Hydrology, Water resources, Water policy, Cost analysis, Colorado, Computer programs, Simulation analysis, Water demand, Water supply, Optimization.

Planner oriented instructions are given for the use of a methodology for the optimal allocation of water resources in a region. The methodology uses a piecewise quadratic programming approach in an input-output framework to model the highly interdependent hydrologic processes governing the distribution and movement of water in natural systems. The methodology is general and applicable to a variety of situations so that the planner can formulate his particular problem. The model is designed to integrate the input-output description of a regional water resource system with the appropriate optimization approach and can handle a variety of cases such as: (1) single or multiperiod allocations, (2) minimization of expected or uncertain costs, and (3) power costs functions or simple linear or quadratic cost functions. A flow chart of the model describes the steps to be taken by the user as well as the model operations. A highly simplified conceptualization of the Cache la Poudre River basin in northern Colorado is used to illustrate the mathematical formulation of a planning problem and the computerized solution of the problem. The characteristics of the water resources of this basin are described along with sample inputs and outputs. Program listing for a single-period and a dual-period allocation model are given along with program flow charts for the FORTRAN IV Program. (Seigler-IPA)

W80-03915

A STOCHASTIC DESCRIPTION OF WET AND DRY SPELLS IN TERMS OF AN EFFECTIVE NUMBER OF DAYS,
Royal Netherlands Meteorological Inst., De Bilt.
H. A. R. De Bruin.
Journal of Hydrology, Vol 45, No 1/2, p 91-99, January 1980. 2 Fig, 2 Tab, 3 Ref, 1 Append.

Descriptors: *Stochastic processes, *Persistence, *Rainfall, Hydrologic data, Hydrology, Rain, Climatology, Meteorology, Synthesis, Frequency, Distribution patterns, *Stochastic description, *Hydrological studies, Climatological studies, Meteorological forecasting, Wet days, Dry days, Random variables.

The influence of persistence on the length of dry and wet spells is shown. A sequence of wet and dry days was treated as a binary process with the value 1 if a day was wet and a value of 0 if a day was dry. A day was called dry when the rainfall amounted to less than 0.25 mm. Other days were called wet. It was shown empirically that for the description of this influence an effective number of days can be used, similar to that of a previous study of Chapman and Bartels, which accounts for the effect of persistence on the variance of mean values. An empirical autocorrelation function was used to reduce the number of parameters. In this form the proposed model contained two parameters. These were the overall probability that a day is dry or wet and a parameter that accounts for persistence. In an appendix an infinite sequence of wet and dry days was considered, on the condition that the mean length of wet and dry runs was infinite. (Roberts-ISWS)
W80-03938

INCORPORATION OF PERCEPTUAL STANDARDS INTO A WATER QUALITY INFORMATION SYSTEM,
Auburn Univ., AL. Dept. of Accounting and Finance.
S. H. Dinius.
In: Proceedings of Third World Congress on Water Resources, Mexico City, Mexico, April 1979. Vol 4, p 1745-1954, 1979. International Water Resources Association, Mexico City. OWRT A-054-ALA(1).

Descriptors: *Pollution, Statistical analysis, Visual pollution, *Water quality, *Water quality index, Water pollution index, Litter pollution, Water quality control, *Visual performance test, Water quality system.

Laymen's perceptual evaluation of varying levels of pollution was measured utilizing a specially designed visual performance test. The test contained water site photographs in which pollution levels were systematically varied. Statistical analysis using analysis of variance and Duncan's Multiple Range Test indicated that subjects evaluation of each water site's level of pollution varied significantly with the quantity of artificial pollution placed there by investigator. Factor analysis isolated three determinants related to human perception of water site quality. One factor was incorporated into a previously designed water quality system which originally linked together chemical analysis of 11 important water pollutants with detrimental effects of the pollutants. The result is one unified water quality system in which water scientists evaluate polluting effects of chemically analyzable pollutants, and laymen evaluate elements related to human value such as obvious pollution.
W80-03966

ENVIRONMENTAL PROBLEMS OF DEVELOPING COUNTRIES,
Urban Development Inst., Bombay (India).
For primary bibliographic entry see Field 6E.
W80-03969

THE WORTH OF STREAMFLOW DATA IN WATER RESOURCES PLANNING: COMPUTATIONAL RESULTS,
Case Western Reserve Univ., Cleveland, OH.
For primary bibliographic entry see Field 2E.
W80-04019

SIMULATED CHANGES IN GROUND-WATER LEVELS AND STREAMFLOW RESULTING FROM FUTURE DEVELOPMENT (1970 TO 2020) IN THE PLATTE RIVER BASIN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
E. G. Lappala, P. A. Emery, and F. J. Otradovsky.
Geological Survey Water-Resources Investigations 79-26 (open-file report), 1979. 82 p, 36 Fig, 11 Tab, 16 Ref.

Descriptors: *Groundwater mining, *Model studies, *Water resources development, *Projections, *Water levels, *Streamflow, Nebraska, Aquifer characteristics, Evapotranspiration, Aquifer systems, Pumping, Water wells, Drawdown, Groundwater recharge, Specific yield, Groundwater availability, Water utilization, Surface-groundwater relationships, Geomorphology, Irrigation, Evaluation, *Platte River basin(Nebr), *The Stream-Aquifer Hydrology Task Force.

Future changes in ground-water levels and streamflow caused by a limited set of water-resources development conditions were simulated with digital models of stream-aquifer systems within the Platte River basin, Nebraska. Simulated water-resources use in the basin included private development of ground water for irrigation, and development of ground water to supply municipal demands of Lincoln and Omaha. Simulated future conditions indicate that significant permanent declines in ground-water levels and streamflows may occur as a result of private development of ground water for irrigation. The largest simulated declines in ground-water levels were more than 80 feet by the year 2020 in upland areas in the Elkhorn and Middle Platte subbasins under conditions of rapid development of all irrigable lands. Simulated depletion of perennial streamflows by ground-water withdrawals indicated that future surface-water supplies may be limited in parts of the basin. Simulated depletions to major streams exceeded 60 percent of average perennial flow in the Elkhorn subbasin under conditions of rapid private development of ground water for irrigation. Simulations that evaluated the effects of combined private ground-water development with proposed Federal development of surface water for irrigation showed that in the project areas, ground-water level declines were reduced compared to 'without project' conditions. In some project areas, simulated ground-water level rises would lead to waterlogged conditions in parts of the Middle Platte subbasin. (Kosco-USGS)
W80-04096

CONSTRUCTION AND APPLICATION OF A WATER QUALITY MODEL FOR THE UPPER BLACKFOOT RIVER BASIN IN THE CARIBOU NATIONAL FOREST, IDAHO,
Idaho Univ., Moscow.
H. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-161268, Price codes: A12 in paper copy, A01 in microfiche. Doctoral Dissertation, November 1979. 252 p, 28 Fig, 19 Tab, 59 Ref, 5 Append. OWRT C-7651 (No 7253)(2).

Descriptors: *Idaho, *Mathematical models, *Mining, *Fertilizers, *Phosphates, Watershed(Basins), Water pollution, Hydrologic data, Model studies, Water quality, Inflow, Discharge(Water), Environmental effects, Blackfoot River.

A steady state, deterministic and one-dimensional water quality model was developed as a management tool for future phosphate mining and processing operations in the Upper Blackfoot River basin. As the demand for phosphate continues to increase and old currently mined areas are depleted it is anticipated that phosphate mining operations in the Upper Blackfoot River basin will increase. Careful management of these mining operations will be needed to minimize or avoid the expected deterioration of water quality in streams of the area. The Boise River water quality model was modified to make it suitable for the Blackfoot River. The model, which is based on the concept of Continuously Stirred Tank Reactor, requires that the river be segmented while the steady-state inputs for atmospheric, hydrologic, and water quality simplify calculations and reduce computational time. The model was calibrated and verified using meteorological, hydrologic and water quality data from two periods in 1976. Given the limitations of the observed data and the complexity of the ecosystem involved, the model was found to be satisfactory. Using hypothetical arbitrary waste discharges at selected points in the basin the model was used to simulate the effect on stream water quality. For greater model accuracy improvements in the data collection system in the basin are needed such as: (1) coordination of various agency data collection programs, (2) additional hydrologic and water quality data collection on ungaged streams, and (3) collection of essential weather data. (Seigler-IPA)
W80-04105

A QUANTITATIVE ANALYSIS OF STREAMFLOW: THE IMPORTANCE OF PRECIPITATION AND GEOMORPHIC FACTORS IN DETERMINING YIELDS FROM SMALL WATERSHEDS,
Idaho Univ., Moscow. Coll. of Letters and Science.
J. J. Kuska.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160609, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Technical Completion Report, February 1980. 27 p, 7 Fig, 8 Tab, 11 Ref. OWRT A-062-IDA(1), 14-34-0001-8014.

Descriptors: *Streamflow forecasting, *Small watersheds, *Idaho, *Rocky Mountains(Idaho), *Regression analysis, Precipitation(Atmospheric), Flow characteristics, Runoff, Channel morphology, Topography, Vegetation, Land use, Watersheds(Basins), Water resources development, Northern Idaho, Meadow Creek basin(Idaho).

Stream flow data from 12 drainage basins located in the rocky mountains in Northern Idaho that covered 12.43 square miles were statistically analyzed and related to factors such as basin length, basin area, square miles, relief ratio, and precipitation levels. The resulting linear regression (R-square value of .87) indicates that geomorphic factors as well as precipitation play a dominant role in explaining variations in streamflow. The regression model was then applied to the much larger Meadow Creek watershed (approximately 243 square miles). The Thiessen method, which assumes linear variation of precipitation between stations and assigns each segment of area to the nearest station, was used to determine precipitation values for the Meadow Creek basin. The regression model, on a number of occasions produced a prediction that was similar to actual yield from the larger basin. (Gladwell-Idaho)
W80-04106

HYDROGEOLOGY AND COMPUTER MODEL OF THE BASS LAKE AREA, ST. CROIX COUNTY, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2H.
W80-04111

TECHNICAL AND ECONOMIC EVALUATION OF AN MSF SOLAR ENERGY POWERED DESALINATION PLANT,
For primary bibliographic entry see Field 3A.
W80-04155

A CHANCE-CONSTRAINED GOAL PROGRAMMING MODEL TO EVALUATE RESPONSE RESOURCES FOR MARINE POLLUTION DISASTERS,
Texas Univ. at Austin. Center for Cybernetic Stud-

ies.
A. Charnes, W. W. Cooper, K. R. Karwan, and W. A. Wallace.
Journal of Environmental Economics and Management, Vol 6, No 3, p 244-274, September, 1979. 4 Fig, 5 Tab, 23 Ref, 1 Append.

Descriptors: *Water pollution, *Mathematical models, *Risks, *Oil spills, *Disasters, Economics, Coasts, Planning, Management, Evaluation, Equipment, Budgets, Waste water(Pollution), Decision making, Probability, Computer programs, Equations, Coast Guard regulations, Dynamic programming.

A model is described for budgetary planning for marine pollution disasters, specifically oil spills; how the model evaluates these risks and their associated performance quality levels is also shown. This model aids Coast Guard managers in formulating policies concerning equipment required to contain major pollution incidents. The combined chance constrained-goal programming model is called Spill Incident Model (SIM). Oil spillage is defined in terms of response stages: pumping (off-loading), containment and removal. The paper describes several model details including (1) accounting constraints which enumerate the oil spill in storage and oil spilled, spilled oil that is contained, oil off-loaded from storage, and oil removed; (2) constraints that relate to equipment deployed to oil contained, removed and unloaded; (3) limitational constraints on available resources for various time periods; (4) probablistic constraints to equipment needs; and (5) goal constraints. Goal programming allows plans to come as close as possible to desired quality and risk levels for each pertinent region and incident type. Coast Guard equipment for marine pollution disasters include skimmers, containment booms, a self-contained high-speed pumping system called ADAPTS and various chemical dispersants. (Danovich-Wisconsin)
W80-04164

OPTIMAL WATER USE AND SALINITY CONTROL FOR ENERGY--UPPER COLORADO RIVER BASIN,
Arizona Univ., Tuscon. Dept. of Soils, Water and Engineering.
M. Flug, W. R. Walker, and G. V. Skogerboe.
Water Resources Bulletin, Vol 15, No 4, p 964-973, August 1979. 5 Fig, 9 Ref. OWRT C-6076 (No 5211)(3).

Descriptors: *Water management(Applied), *Optimization, *Mathematical models, *Water resources, *Energy development, *Upper Colorado River, *Colorado, Salinity, Oil shale, Coal, Modelling, Management, Linear programming, Water utilization, Efficiencies, Water demand.

The Upper Colorado River Basin contains significant amounts of undeveloped fuel resources. Development of these resources requires an adequate water supply. Present water quality is at a concentration where increased salinity would result in economic detriment to holders of downstream water rights. A mathematical model has been developed to assess the relationships between water availability in the Basin, salinity, energy production, and the economics of development. Alternative scenarios regarding synthetic fuel production are evaluated in terms of differential energy development costs, various institutional constraints, and restrictions pertaining to water use and water quality distribution. Water-related data include the quantity of water available, the average salinity, and the contribution of precipitation to the river system. Water quality control involves managing salinity impacts upon the remaining flows of the Colorado River. Actual salinity impacts resulting from energy developments can be broken down into three primary sources: water consumption, return flows, and disturbed land areas. The structure of the energy-water-salinity problem formulation is represented by a set of linear equations and inequalities which can be solved by linear programming techniques. The salt and water exchanges in mining, processing, and spent fuel disposal processes have been incorporated as part of a two-level minimum cost linear programming algorithm. The simulation provides an optimal use of Upper Colorado River water for levels of energy output such that salinity concentrations are maintained below predetermined levels. (Iervolino-NC)
W80-04190

6B. Evaluation Process

BENEFITS OF LONG-RANGE STREAMFLOW PREDICTION,
California Univ., Los Angeles. Dept. of Systems Engineering.
W. W-G. Yeh, L. Becker, M. J. Cohn, and R. Zettlemoyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-156276, Price codes: A31 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, Contribution 181, February 1980, 31 p, 11 Fig, 9 Tab, 2 Append. (California Water Resources Center Project UCAL-WRC-W-535).

Descriptors: *Streamflow forecasting, *Multiple-purpose reservoirs, *Surface water, *Groundwater, Streamflow, Reservoirs, Water supply, Water storage, Available water, Projections, California.

This study supplements Department of Water Resources Projects Hydrospect and Hydrospect II by assessing improved benefits that might be gained from the use of long-range streamflow forecasts in the operation of a typical multipurpose reservoir. Long-range is defined as a period of time ranging from one month to one year. The Oroville-Thermalito reservoir system is selected for study; major benefits to be derived from long-term streamflow prediction for this system are hydropower generation; water conservation for irrigation and/or other beneficial uses; and decreased seepage damage to crops. Flood control benefits are potentially high but those benefits are more amenable to short-term rather than long-term forecasting. Incremental benefits are determined as functions of forecast time and accuracy on the basis of general adherence to current operating rules. The reservoir is theoretically operated over the 1914-73 time period; forecasts and comparisons are based on the historical streamflows. Procedure failure is defined as inability to meet a minimum storage constraint at any time over the 60 year period. To provide an additional evaluation of benefits from forecasting, analyses are also made using the historical means as estimates of future streamflows. This study also explores, quantitatively, the economic benefits from optimal operation of the surface water/groundwater system, given advance estimates of future surface water supplies. (Snyder-California)
W80-03901

PARTICIPATION IN WATER RESOURCES PLANNING: LEADER AND NON-LEADER COMPARISONS,
Purdue Univ., IN. Dept. of Sociology and Anthropology.
H. R. Potter, G. M. Grossman, and A. K. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-156128, Price codes: A03 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No 107, 1980. 33 p, 13 Tab, 27 Ref. OWRT A-053-IND(1).

Descriptors: Social participation, Economic models, *Water resources, *Political aspects, *Social aspects, Environment, Model studies, Community leaders, *Public participation, Non-leaders, *Environmental problems.

The purposes of this research are to provide descriptive comparisons of community leaders and the general public on (1) how they perceive environmental problems, (2) how they view opportunities for citizen participation, (3) the extent to which they participate in decision making, and (4) to compare alternative models of community decision making. Data are from personal interviews with 46 leaders and a sample of 139 residents of Tippecanoe County, Indiana. The differences between leaders and the public were not generally great in how they see environmental problems, however, leaders who see problems are more concerned, although they are more likely to think pollution will improve in the near future. The public is more likely to think not enough is being done. Both groups support citizen participation, however leaders participate much more than the public. Nevertheless, both evaluate the effectiveness of techniques for political participation similarly. Two models of community decision making, knowledge-participation and socio-economic models, produce similar, mixed results in explaining environmental attitude. A model that combines the variables of both of these models does somewhat better, but still varies depending on the indicator of the dependent variable. Political participation, leadership and education each have independent effects in the regression model where R is statistically significant. Greater participation and more education leads to perceiving more environmental problems, while leaders perceive fewer problems. Problems of measuring environmental attitude are discussed.
W80-03903

PUBLIC PARTICIPATION IN THE NORTH CAROLINA STATEWIDE 208 WATER QUALITY PLANNING PROGRAM: AN EVALUATION OF THE PROBLEM IDENTIFICATION PHASE OF PLANNING,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
B. Stiftel, S. Herzberg, and D. R. Godschalk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-157597, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina. Working Paper No 75, June 1979. 146 p, 57 Fig. OWRT-A-096-NC(2), 14-34-0001-8035.

Descriptors: *Water quality control, *Planning, Costs, Evaluation, Programs, Public participation, *North Carolina, *Water quality planning program.

The Problem Identification phase of an analysis of the public participation effort of the North Carolina statewide '208' water quality planning program is presented. The analysis was based on 7 criteria: accessibility, involvement, public awareness, staff awareness, effect on staff and plan, effect on public and plan, and cost. The major results indicate that the public participation program was successful from the viewpoint of both planners and participants. Findings with respect to 10 participation methods, including circulation reports, meetings, goal setting workshops and advisory committees, are presented.
W80-03909

THE PYRAMID LAKE-NEWLANDS PROJECT CONTROVERSY, 1903-1926,
Nevada Historical Society, Reno.
J. M. Townley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-157928, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada System, Reno. Completion Report, February 1980, 9 p. OWRT A-074-NEV(1), 14-31-0001-7060.

Descriptors: *Nevada, *Irrigation programs, *Federal project policy, *Water policy, Land reclamation, History, Indian reservations, Land use, Water storage, Water supply, Water users, Water demand, Lake Tahoe, Pyramid Lake, Carson River, Truckee River.

Historical records were used to study the Newlands Project, Nevada's initial Federal reclamation project, during the period 1903 through 1926. Since 1903 there has been controversy over the allotment of Truckee River water among users. In 1923 the Bureau of Reclamation turned over operational control of the project to the locally directed Truckee-Carson Irrigation District. Early U.S. Department of Interior actions to supply water to the Newlands Project and the effect on Pyramid Lake, now the Pyramid Lake Paiute Reservation,

were studied. Records from newspapers, archival collections, and various Federal agencies were used to investigate the problems encountered in construction of the Truckee-Carson Project, the struggle for control of Lake Tahoe as a storage reservoir, and the treatment of the Paiute as a homesteader on the project. From this historical study three publications were prepared that will probably be consulted when the litigation concerning the Truckee-Carson Irrigation District, the Pyramid Lake Pauite Reservation, and the water users of the Truckee and Carson Rivers is examined in Federal court. The study shows that original estimates of potentially reclaimable acreage were high and the actual 60,000 acres reclaimed are not enough to economically justify the creation of the project. Failure to purchase control of the Tahoe City dam forced up land prices in the reclamation district from $22/acre to over $100/acre. The Paiute Indians lost approximately 30,000 acres, were excluded from entry within the project, and were isolated on a reservation with no consideration of Winters Doctrine rights. (Seigler-IPA)
W80-03917

UNDEVELOPED HYDROPOWER AS A POTENTIAL ENERGY SOURCE IN IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
C. C. Warnick, and L. F. Heitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-157399, Price codes: A03 in paper copy, A01 in microfiche. Research Technical Completion Report, November 1979. 24 p, 3 Fig, 5 Tab, 10 Ref. OWRT A-057-IDA(2).

Descriptors: *Idaho, *Pacific Northwest U.S., *Hydroelectric plants, *Electric powerplants, Hydroelectric power, Energy conversion, Flow duration, Flow measurement, Flow rates, Water resources, Hydrology, Regression analysis, Washington, Oregon, Montana, Wyoming, Nevada.

The potential energy available in both regulated and unregulated streams in Idaho and the Pacific Northwest through the use of small scale hydro development was surveyed. Increasing energy demands, the rising cost of fuels for steam power plants, and recent advance in the production of smaller units have combined to make the construction of small scale, low-head hydro developments a viable source of energy. For the survey a technique was developed to find flow duration information along reaches of streams that did not have flow records due to inadequate gaging. Also a method for estimating flow duration curves for regulated streams was developed and applied. To determine head for power computations the difference in elevation at the inflow and outflow points of a reach was used. Results showed that most plants would be of the run-of-river type installation. Synthetic flow duration curves were based on a technique of regression equation between flow of a given interval and the average annual flow. Parametric curves resulted from the unregulated stream flow duration curves. A preliminary social, political, and environmental feasibility evaluation was also made for each reach with theoretical energy potential. Summaries of the survey results are included. Data from the Idaho survey were catalogued and computerized for easy retrieval and processing. Considerable theoretical potential was found for small hydro in the state of Idaho. (Seigler-IPA)
W80-03918

AN ECONOMIC EVALUATION OF THE SALINITY IMPACTS FROM ENERGY DEVELOPMENT: THE CASE OF THE UPPER COLORADO RIVER BASIN,
Utah Water Research Lab., Logan.
R. Narayanan, S. Padungchai, and A. B. Bishop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159932, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-79/07, December 1979. 71 p, 20 Fig, 45 Tab, 2 Append. OWRT-B-141-UTAH(1), 14-34-0001-7192.

Descriptors: *Energy development, Water resources, *Salinity, *Mathematical models, *Economic feasibility, Cost-benefit analysis, Water allocation(Policy), Water quality, *Salinity reduction, Colorado River Basin, Upper Colorado River Basin.

To analyze the effect of potential energy development on water allocation and water quality in the Upper Colorado River Basin, a linear programming model is formulated. Using the model, changes in salinity are predicted. Further, least-cost strategies to maintain the established numeric salinity criteria through both structural and non-structural alternatives are developed. The effectiveness of alternative control measures are examined within given institutional constraints. Based on cost-benefit analysis, optimal salinity levels over time are proposed. The economic feasibility of presently planned structural measures to reduce salinity is investigated and contrasted with non-structural alternatives.
W80-03964

THE OPTIMAL MANAGEMENT OF TRANSBOUNDARY RENEWABLE RESOURCES,
British Columbia Univ., Vancouver.
G. R. Munro.
The Canadian Journal of Economics, Vol 12, No 3, p 355-376, August 1979. 2 Fig, 20 Ref.

Descriptors: *International waters, *Fisheries, *Mathematical models, *Fish management, *Boundary disputes, *Adjacent land owners, International law, Legal aspects, Foreign trade, Foreign waters, Economics, International Joint Commission, Joint costs, Optimization, Model studies, Payment, Royalties, Commercial fishing, Economics, Water law, Boundaries(Property), Fish harvest.

Optimal management of renewable resources such as a fishery is extended from an assumption of ownership and control by a single state to ownership by two adjoining political jurisdictions. Resource management conflicts are easier to resolve if one co-owner can make side payments to the other to balance interest. A dynamic model of fisheries is combined with Nash's theory of two-person co-operative games. Conflict in management strategies between the co-owners is viewed in terms of varying propensity of each state to invest or disinvest in the resource. Conflicting views on optimal stock or biomass on the part of each state implies disagreement over optimal harvest rates. Three kinds of management conflicts are considered: (1) differences in perceived social rates of discount, (2) different harvesting costs, and (3) varying consumer preferences. Additional research in regard to multinational resource ownership should be obtained for fishery resources off West Africa in the Atlantic or the tuna fishery in the Pacific. In addition, policy consequences of allowing parameters to fluctuate through time should be examined. Further, implications should be investigated of joint management programs of limited resource. Finally, numerous actual cases of jointly owned renewable resources are being created through the emerging system of 200-mile exclusive economic zones in coastal waters. (Harris-Wisconsin)
W80-03970

CULTURAL DIFFERENCES IN PERCEPTIONS OF ENVIRONMENTAL PROBLEMS,
State Univ. of New York at Buffalo. Dept. of Political Science.
N. E. McGlen, L. W. Milbrath, and H. Yoshii.
Technological Forecasting and Social Change, Vol 14, No 2, p 97-114, July 1979. 10 Tab, 7 Ref.

Descriptors: *Surveys, *Japan, *United States, *Environment, *Social aspects, Erie County(NY), Hamilton County(NY), Sampling, Political constraints, Environmental control, Regulation, Governments, Social values, Social participation, Political aspects, Attitudes, Policy.

Comparison of results of attitudinal and opinion surveys conducted in Japan and the United States show that perceptions about the environment vary according to prevailing national culture. In 1974 interviewing, a Japanese team polled a nationwide random sample; US polling was limited to samples in heavily industrial Erie County and environmentally unspoiled Hamilton County, both in New York. More than twice as many Japanese as Americans rank the environment as the first or second most important national problem. Several components widely perceived by Americans as part of the environmental problem (such as population growth, energy availability, urban blight) are considered irrelevant by Japanese. Thus Japanese define the environmental problem narrowly as pollution alone, while Americans give it a broader definition. Japanese are more likely to blame the government for pursuing a wrong policy (unlimited industrial expansion) in assigning causes for environmental problems; Americans are inclined to blame people such as themselves for personal carelessness in causing these problems. Expectedly, Japanese are also more likely to want the national government to solve the environmental problem; Americans prefer a greater degree of individual initiative. Americans are also much more likely than Japanese to take part in environmental cleanup campaigns and similar mass activities. It concludes that people who live in environmentally damaged cities of Japan are more likely than American to perceive environmental problems as serious and are more willing to accept strong governmental action to correct it. (Harris-Wisconsin)
W80-03973

THE COSTS AND BENEFITS OF WATER METERING,
International Bank for Reconstruction and Development, Washington, DC. Energy Water and Telecommunications Dept.
R. N. Middleton, R. J. Saunders, and J. J. Warford.
Journal of the Institution of Water Engineers and Scientists, Vol 32, No 2, p 111-122, March 1978. 3 Fig, 9 Ref, 2 Append.

Descriptors: *Cost-benefit analysis, *Instrumentation, *Domestic water, *Water consumption(Except consumptive use), Cost-benefit theory, Feasibility, Water conservation, Use rates, Water rates, Water utilization, Potable water, Cost analysis, Cost allocation, Tariff, Prices, Economics, Consumptive use, Asia, Developing countries, Costs, Water allocation(Policy).

The decision of whether or not to meter individual households, examined in this study in terms of its theoretical framework and exemplified with water management experiences from several Asian cities, is subject to cost-benefit analysis. Quantifiable benefits developed through water metering are reduced operating and maintenance costs of the existing water supply and wastewater disposal facilities; these benefits are realized through reduction of water usage in the metered households. Other metering benefits are more difficult to quantify; they include: (1) more equitable allocation of costs to users, (2) general water conservation, and (3) better-identified demand trends in metered geographic areas. Costs include those to suppliers (Meter purchase and installation, setting up repair and storage facilities, meter inventories and replacement) and those borne directly by consumers (reductions in wasteful water uses and general water consumption). Because little data is available on the relationship between consumption and price it is difficult to estimate the value of various costs. Decisions on whether to adopt metering should be made in terms of the amount of reduced consumption which is sufficient to justify metering costs (assuming that reductions occur in all cases if meters are installed in households). In all but one of six Asian cities studied, water metering was cost justified. (Harris-Wisconsin)
W80-03974

DEMINERALIZATION OF BRACKISH MUNICIPAL WATER SUPPLIES--COMPARATIVE COSTS,
Miller and Associates, Boulder, CO.
E. F. Miller.
Journal of the American Water Works Association, Vol 69, No 7, p 348-351, July 1977. 1 Fig, 4 Tab, 31 Ref.

Descriptors: *Water treatment, *Reverse osmosis, *Electrodialysis, *Comparative costs, *Municipal water, *Demineralization, Colorado, New Mexico, Texas, Brackish water, Impaired water quality, Ion exchange, Groundwater, Economics, Water purification, Water softening, Cost analysis, Value engineering.

Comparisons between 1970-73 and 1977 cost analyses for treating brackish groundwater in 13 municipalities in Colorado, New Mexico and Texas, reveals that reverse osmosis preceded by an ion-exchange dealkylation (softening) in the case of high salinity, is the most inexpensive process for lowering brackish water mineral content. In 1970-73 treatment costs ranged 6.9-41.5 cents/cu m. For four of the 13 municipalities electrodialysis was the least costly treatment process. Reverse osmosis was most cost-effective for four other municipalities. For the remaining five municipalities, the least costly process was either exchange softening and either electrodialysis of reverse osmosis in combination. Cost projections for 1977 ranged 9.8-51.5 cents/cu m. These are incremental costs above costs incurred for pumping, removing iron, softening and sterilizing groundwater supplies to these communities. Technological improvements and the increased cost of energy are the main reasons reverse osmosis has become the least-cost process. Reoptimization of reverse osmosis system designs to employ looser membranes is warranted because of rising energy costs. No such opportunities can be seen for lowering energy requirements for electrodialysis, and the competitive standing of such systems is now limited. (Harris-Wisconsin)
W80-03978

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ. Tucson. Dept. of Geosciences.
For primary bibliographic entry see Field 2F.
W80-04013

THE WORTH OF HYDROLOGIC DATA FOR NONOPTIMAL DECISION MAKING,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. R. Davis, L. Duckstein, and R. Krzysztofowicz.
Water Resources Research, Vol 15, No 6, p 1733-1742, December 1979. 4 Fig, 4 Tab, 22 Ref. NWS 6-35229, NSF ENG 76-20280.

Descriptors: *Hydrologic data, *Value, *Mathematical models, *Decision making, Sampling, Risks, Methodology, Analytical techniques, Networks, Systems analysis, Data collections, Planning, Estimating, Streamflow, Floods, Hydraulic structures, Culverts, Design, Tile drainage, Flood forecasting, Projects, Information-response system.

Data are of value in the design and operation of water resource projects because they provide information about uncertain states of nature. This information can in turn be used to reduce the risks inherent in the project. In this paper, risk calculations from the preposterior analysis of statistical decision theory were extended to cover nonoptimal decisions. Risk was measured in terms of the project objectives by embedding the data network into an information-response (IR) system. The value of addition or improvement to the data base was measured by the change in the risk. Measures of the performance of the IR system were developed. From these measures, the efficiency of the information subsystem, the response subsystem, and the overall IR system were defined. These concepts are illustrated by a simple example in which the additional data sample for estimating the 6 1/4-year flow was shown to have different values (negative in one case), depending on the estimation method or decision rule used. Five anomalies and paradoxes in the literature concerning the worth of data were explained. Within the framework of the information-response model and its measures of performance and efficiency, additional data always improve information efficiency but may increase or decrease response efficiency. The relative increase or decrease of these efficiencies determines the worth of additional data for nonoptimal decision making. (Humphreys-ISWS)
W80-04044

TERMINATION OF HYDROLOGIC DATA COLLECTION (A CASE STUDY),
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
L. J. Lane, D. R. Davis, and S. Nnaji.
Water Resources Research, Vol 15, No 6, p 1851-1858, December 1979. 8 Fig, 3 Tab, 19 Ref.

Descriptors: *Hydrologic data, *Demonstration watersheds, *Research priorities, *Decision making, *New Mexico, *Arizona, Value, Precipitation(Atmospheric), Runoff, Methodology, Analytical techniques, Analysis, Management, Statistical methods, Homogeneity, Sampling, Networks, Terminating data collection.

The operation of seven experimental watersheds near Albuquerque, New Mexico, and Safford, Arizona, which only obtain data on precipitation and runoff, was examined to determine (1) if their operation should continue as is, (2) if their data collection abilities should be expanded, or (3) if their operation should be discontinued. The decision-making procedure is modeled in terms of the theory of 'bounded rationality' rather than classical optimization theory. The choice of alternatives was subject to three constraints: that the resources for data collection activities at Southwest Watershed Research Center would not be increased, that it be administratively feasible, and that no research program be seriously impaired. A problem-data matrix that showed the data needs for several research objectives was constructed. Based on this matrix and an estimate of the value of the research to the agricultural community, the three alternatives for the operation of seven watersheds were evaluated. Considering the constraint of no additional resources and of administrative feasibility, the alternative of closing the seven watersheds was the best. To check that the third constraint was not violated, regional studies were made to compare precipitation and runoff characteristics of the Safford and Albuquerque watersheds with other experimental watersheds. A Bayesian decision analysis on the worth of future data was made. The regional analysis and the Bayesian study showed that closure of the watersheds would be detrimental to the precipitation and runoff data base, but not to the extent of impairing research objectives. The Albuquerque and Safford watersheds were closed in June 1976. (Humphreys-ISWS)
W80-04049

A STATISTICAL APPROACH TO STATION DISCONTINUANCE,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04050

WATER RESOURCES OF THE LOWER ELWHA INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-04086

ECONOMICS AND WATER CONSERVATION PART 2,
Department of the Interior, Washington, DC. Office of Minerals Policy and Research Analysis.
For primary bibliographic entry see Field 3D.
W80-04149

RECREATION AT THE MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM,
Institute for Water Resources (Army), Fort Belvoir, VA.
L. G. Antle.
Water Resources Bulletin, Vol 15, No 5, p 1408-1417, October 1979. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Recreation, *Management, *McClellan-Kerr Navigation System, *Multiple-purpose reservoirs, *Social impact, *Arkansas River, Recreation demand, Land use, Benefits, Costs, Cost-sharing, Benefits, Costs, Regional development, Economic impact, Economics, Lakes, Employment, Income, Employment opportunities, Arkansas, Oklahoma, Water level fluctuations, Water utilization.

Analysis of recreation impacts of the McClellan-Kerr Arkansas River Navigation System during 1963-1976 show some rich benefits and substantial problems; results suggest that the share of financial resources obtained from recreational users should be increased and that management activities should be transfered from the Corps of Engineers to non-federal agencies. The physical system was designed to provide multiple purpose capability including flood control, hydroelectric power, navigation, water supply, recreation, and fish and wildlife enhancement. Project benefits include increases in employment, income, economic dvelopment and migration. Total regional employment has increased from 417,183 in 1960 to 518,464 in 1970. Aggregate recreation expenditures are estimated at $193 million in 1974 and $224 million in 1975. Social impact analysis shows that 200,000 persons were directly influenced to migrate into the area since 1970 because of job opportunities and recreation advantages. However, the same factors which contribute such dramatic beneficial impacts also lead to formidable management problems such as financing and staffing recreation programs and managing conflicts between desirable uses of multiple purpose systems. Recreation impacts place stress on Corps funds and staff, both of which are limited due to federal budget constraints. Heavily used recreational lakes are a continual source of public conflict with respect to lake levels for other uses such as holding flood flows or releases for power and water supply. The paper concludes with strategies for Corps policy. (Danovich-Wisconsin)
W80-04153

TECHNICAL AND ECONOMIC EVALUATION OF AN MSF SOLAR ENERGY POWERED DESALINATION PLANT,
For primary bibliographic entry see Field 3A.
W80-04155

ENVIRONMENTAL ALTERNATIVES AND SOCIAL GOALS,
DuPont Co., Wilmington, DE.
For primary bibliographic entry see Field 6E.
W80-04157

REBUTTAL OF 'ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A CRITIQUE',
Georgia Univ., Athens. Inst. of Ecology.
E. P. Odum.
Coastal Zone Management Journal, Vol 5, No 3, p 231-237, March, 1979. 13 Ref.

Descriptors: *Ecosystems, *Economics, *Energy, *Market value, *Environment, *Pricing, Ecology, Wetlands, Solar energy, Energy budget, Energy flow, Decision making, Economic justification, Balance of nature, Evaluation, Land appraisals, Land use, Conservation, Land development, Resources, Management.

This article points out how the natural environment's goods and services are grossly undervalued in conventional economic accounting. Economists believe that new technology will always find substitutes for items which become scarce. This is often true for synthetic goods and services; but for land and life-support systems such as water or food no substitutes exist. Narrow economic views, that it is permissible to destroy resources such as an estuary if alternative economic activity equals or exceeds the original activity dollarwise, are challenged. The more preferable alternative is to build factories on high ground so that industry and marshes can be coupled for greater long-term economic gain. The market system fails when the monetary return on one gallon of water is much higher when used for manufacturing or mining than for agriculture or drinking. Natural life-support systems cannot be priced; people cannot live without them. Natural solar-powered ecosystems

interface with artificially fuel-powered urban-industrial systems and fuel-subsidized agricultural systems to provide a desirable synergism. Interfaced natural ecosystems can supply one-third the total energy maintaining a city in a healthy state in terms of economic and quality-of-life dimensions. Total energy flow, as opposed to net energy output, is used as a basis for calculating the value of natural ecosystems. (Danovich-Wisconsin)
W80-04158

ON THE COST-BENEFIT ANALYSIS OF PORT PROJECTS,
University Coll. of North Wales, Bangor.
S. R. C. Wanhill.
Maritime Policy and Management, Vol 5, No 4, p 315-326, September, 1978. 2 Fig, 7 Ref, 1 Append.

Descriptors: *Investment, *Harbors, *Economics, *Benefits, *Cost-benefit analysis, Port authorities, Shipping, Navigation, Equations, Import, Export, Costs, Elasticity of demand, Elasticity of supply, Mathematical models, Mathematics, Curves, Welfare(Economics), Theoretical analysis.

Mathematical models are presented which examine whether port investment projects reduce shipping costs and which deal with both exporter and importer cases. The theoretical background to port investment projects is outlined and compared against common practices that consider benefits of port improvements as cost savings accruing to shipowners. These savings result from reductions in congestion and turnaround time in the case of improved berthing and handling facilities and reductions in congestion and shipping costs/ton cargo when channel deepening takes place, permitting larger vessel use. When calculating welfare changes, the major constraints are time and data availability. The problem involves estimating demand and supply functions for imported and exported goods and their associated elasticities. The crucial step relates to assumptions that export supply curves for trading nations other than the home country are horizontal. Assumption appeal and practical relevance clearly depends upon circumstances; however, this assumption is realistic in the case of small economies such as developing countries. (Danovich-Wisconsin)
W80-04160

OPTIMIZING THE BENEFITS OF INVESTMENTS IN SEWERAGE IN DEVELOPING COUNTRIES,
WAPORA Inc., Washington, DC.
U. P. Gibson.
Progress in Water Technology, Vol 10, No 5/6, p 1211-1216, 1978. 11 Ref.

Descriptors: *Optimization, *Economics, *Investment, *Sewerage, *Developing countries, *Environmental sanitation, Benefits, Rural areas, Sewage treatment, Public health, Sewage disposal, Social aspects, Water supply, United Nations, Water resources development, Planning, Governments, Financing, Loans, Human diseases.

Optimization techniques cannot be applied to sewerage and other forms of sanitary sewage disposal planning in developing countries. Present knowledge does not permit sewerage investment optimization. Attempts at rigorous quantification are likely to be futile, non-transferable and of questionable benefit. It is universally recognized that adequate quantities of safe water together with sewage disposal are basic necessities for good health and productivity. In 1975 only 646 million people of 33% of the total population in developing countries were adequately served by public sewers or household systems. These include only 15% rural population and 75% of the urban population. Adequate disposal facilities for human wastes are greatly significant for public health and economic development. Human excreta is the principal source of pathogenic organisms which cause many communicable diseases transmitted by water, food, and flies. The United Nations Conference on Human Settlements recommends that by 1990 all populations have community water supply and sewerage services. This target requires the following: Sewage disposal and water supply should be recognized as a basic infrastructural element and less as social services. Greater emphasis must be placed on serving needs of the rural poor. Since sewage disposal investment is greater than developing countries' resources, much greater external assistance is needed. Donor countries and international agencies should allow much greater flexibility in loan criteria by including prevailing economic and social conditions. (Danovich-Wisconsin)
W80-04163

SOME POLICY IMPLICATIONS OF WATER DEVELOPMENT,
Biswas and Associates, Ottawa (Ontario).
For primary bibliographic entry see Field 6D.
W80-04184

ENVIRONMENTAL IMPLICATIONS OF WATER DEVELOPMENT FOR DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 6D.
W80-04186

OPTIMAL WATER USE AND SALINITY CONTROL FOR ENERGY--UPPER COLORADO RIVER BASIN,
Arizona Univ., Tuscon. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 6A.
W80-04190

BIOECONOMIC MODEL OF THE GULF OF CARPENTARIA PRAWN FISHERY,
British Columbia Univ., Vancouver. Dept. of Mathematics.
C. W. Clark, and G. P. Kirkwood.
Journal of Fisheries Research Board of Canada, Vol 36, No 11, p 1304-1312, 1979. 3 Fig, 3 Tab, 3 Ref.

Descriptors: *Fisheries, *Fish management, *Gulf of Carpentaria, Australia, *Mathematical models, *Shrimp, Commercial fishing, Australia, Model studies, Optimization, Economics, Competition, Long-term planning, Optimum development plans, Shellfish, Commercial shellfish, Fish harvest, Fishing gear.

The study presents a bioeconomic model pertaining to a recently developed prawn fishery in the Gulf of Carpentaria and adjacent waters in Northern Australia. However, the constant annual recruitment rate on which optimal long-term fleet size is based, is unrealistic. Additional biological studies concerning recruitment rates and more detailed economic surveys are needed to alleviate some of the shortcomings of the present model. The model employs 21 parameters to describe performance of two classes of vessels (brine and freezer trawlers) exploiting several stocks of prawns. The number of each vessel class entering the fishery under free access is predicted. When predictions are compared to the real situation, neither vessel type described by the model is optimal, but less expensive, smaller freezer trawlers are more appropriate. Thus many brine vessels are currently being fitted with freezing facilities, while newly constructed freezer trawlers have smaller dimensions than previous ones. Linearity of the model, which concludes that optimal allocation requires the entire fleet to be allocated to one stock at one time, is contradicted by data from the real situation. Due to such factors as crowding and interference, saturation of unloading facilities, and competition for prawn catch by individual vessels, the fleet is spread over the stocks. (Harris-Wisconsin)
W80-04199

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DYNAMIC WATER MANAGEMENT: AN OPTIMAL CONTROL APPROACH,
California Univ., Davis. Dept. of Agricultural Economics.
J. E. Noel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-157084, Price codes: A11 in paper copy, A01 in microfiche. PhD Dissertation, January 1979, 212 p, 11 Fig, 28 Tab, 7 Appen. (California Water Resources Center Project UCAL-WRC-W-526). OWRT-B-187-CAL(2).

Descriptors: *Water management(Applied), *Computer models, *Linear programming, Economics, Optimization, California, Water supply, Water demand, Evaluation.

A dynamic water management model is used to determine the socially efficient allocation of the region's ground and surface water resources. The allocation problem is divided into three major areas: (1) spatial allocations, (2) intertemporal allocations and (3) conjunctive use allocations. The management model uses the present value of current use and present value of storage to simultaneously determine all three allocation problems. A linear programming model is formulated to provide shortrun impact analysis of the agricultural sector and to provide derived demands for agricultural water and a linear quadratic control model is used for determining the socially optimum spatial and intertemporal allocations of water over a thirty-year planning horizon. The two models interact with each other in an iterative procedure permitting overall optimization of the economic and hydrologic system. The dynamic water management model is used to analyze the impact of four different energy cost senarios on the socially optimal allocation of ground and surface water and to empirically evaluate the economic validity of taxation and pro-rata quota policies for achieving a socially optimum allocation of groundwater. (Snyder-Calif)
W80-03905

PLANNING FOR NONPOINT POLLUTION CONTROL IN NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 5B.
W80-04130

LEAST COST SOLUTIONS TO THE PROBLEM OF EFFLUENT ABATEMENT IN URBAN SYSTEMS,
Commerce and Business Administration, Vancouver (British Columbia).
For primary bibliographic entry see Field 5D.
W80-04154

COST BEHAVIOR AND WATER SYSTEMS,
West Virginia Univ., Morgantown. Coll. of Business and Economics.
P. C. Mann, and J. L. Mikesell.
Water Resources Bulletin, Vol 15, No 5, p 1301-1307, October 1979. 1 Tab, 9 Ref.

Descriptors: *Water supply, *Density, *Water utilization, *Economies of scale, *Cost analysis, Water costs, Costs, Statistics, Water consumption(Except consumptive use), Utilities, Equations, Production, Distribution, Regression analysis, Water rates, Unit costs, Water demand, Water delivery.

Only scale and per-capita use significantly affect water system costs, while consumer density has little effect. Water consumers benefit from being served by large systems and being located in service areas characterized by relatively high per capita usage. Analysis provides little evidence that more dense areas have lower water service costs than less dense areas. However, the results might have been different if cost data could have been disaggregated into production and distribution components. Water service cost analyses are hindered by the lack of homogeneity across firms within the water utility industry. Relatively low coefficients of determination for equations reflect some analysis limitations. Cost variables suffer from a lack of disaggregation. Several nonquantifiable variables, such as differences in regulation, create cost differences not reflected by traditional variables. Differences in accounting procedures, financial environment, climate, terrain and hydrological conditions also affect cost differences.

Some unexplained cost variation is also attributed to internal efficiency differences across water systems. (Danovich-Wisconsin)
W80-04156

REBUTTAL OF 'ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A CRITIQUE',
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 6B.
W80-04158

CAPITAL COST FUNCTIONS OF A SURFACE WATER TREATMENT PLANT AND ITS COMPONENTS,
Illinois Univ. at Urbana-Champaign. Coll. of Commerce and Business Administration.
H. Hinomoto.
Water Resources Research, Vol 13, No 6, p 873-876, December 1977. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Treatment facilities, *Capital costs, *Diseconomies of scale, Water treatment, Costs, Economics, Economies of scale, Surveys, Regression analysis, Cost analysis, Investment, Geographical regions, Sewerage, Public utilities, Waste water treatment, Water pollution control, Operating costs

Analysis of 12 water treatment plants with 1-12 mgd capacity range constructed 1965-1972 shows diseconomies of scale in capital costs. This is contrary to investment cost functions showing economies of scale in past studies on surface water plants. Beta estimated values in past studies, including Koenig, Ackermann and Orlob and Lindorfs, were 0.67 showing economies of scale. The present study has 1.166 beta value, indicating small but positive economies of scale. Cost data includes: (1) site preparation and outside work; (2) building and structure; (3) piping, valves and gates; (4) equipment; and (5) utility work. Six plants are located in North Central U.S., four in the North Atlantic region, and two in the South Atlantic region. Although study results indicate diseconomies of scale in investment cost, plant use may actually become increasingly attractive with capacity. Both investment cost and operating cost need to be determined. Long-run technological change may affect plant design or construction procedure which may change relative magnitudes of labor, material and equipment costs constituting total costs. In particular, labor-saving devices installed for plant operation may increase plant investment cost but decrease operating cost. (Danovich-Wisconsin)
W80-04161

WATER RATE POLICY: LESSONS FROM LESS DEVELOPED COUNTRIES,
International Bank for Reconstruction and Development, Washington, DC. Dept. of Energy, Water and Telecommunications
J. J. Warford, and D. S. Julius.
The Journal of the American Water Works Association, Vol 71, No 4, p 199-203, April, 1979. 1 Tab, 9 Ref.

Descriptors: *Water rates, *Water policy, *Developing countries, *Public utilities, *Water supply development, Urban sociology, Utilities, Water supply, Planning, Prices, Tariff, Income, Income distribution, Water demand, Long-term planning, Rates, Social aspects, Marginal costs, Economic efficiency, Economies

Technologically advanced countries can learn about water pricing from less-developed countries (LDCs) since physical and financial constraints faced by LDCs are appearing in slightly different forms in Los Angeles and New York. More long-term planning goes into tariff setting in LDCs than in developed countries. Three factors (narrow revenue base, rapidly growing demand, and resulting necessity to explore alternative service levels) have shaped water utilities' rate-making philosophy in LDCs. Most LDCs have some type of increasing block tariff whereas in the U.S. declining block tariffs are widespread. Some water systems in LDCs are designed for consumption levels lower than 200-400 l pdc or without sufficient pressure to meet peak demands, these are cost-saving alternatives. The widely shared concern that the poor be provided with at least minimal water service at low cost forces LDCs to include marginal cost pricing for large customers. The U.S. is experiencing problems similar to those of LDCs. Local resource base in U.S. cities is limited by growing demands of competing needs gaining approval of new bond issues which finance water and sewer expansion is increasingly difficult. Although water demand in the U.S. is not expected to grow more rapidly than in the past, the changing supply situation results in conditions similar to those in LDCs. The most effective way to encourage conservation is by pricing water used in excess of basic sanitation needs at its full marginal cost. (Danovich-Wisconsin)
W80-04162

6D. Water Demand

DYNAMIC WATER MANAGEMENT: AN OPTIMAL CONTROL APPROACH,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W80-03905

WATER SCARCITY AND THE POLITICS OF PLENTY IN THE FOUR CORNERS STATES,
Arizona Univ., Tucson.
H. Ingram, N. Laney, and J. R. McCain.
The Western Political Quarterly, Vol 32, No 3, September 1979. p 298-306. 9 p, 3 Tab, 21 Ref. OWRT B-056-ARIZ(3), 14-34-0001-7111.

Descriptors: *Water policy, *Water allocation(Policy), *Water supply, *Administration, Colorado, New Mexico, Arizona, Utah, Agriculture, Irrigation water, Urbanization, Colorado River Basin, Legislation.

The allocation of water resources in the fast growing arid Four Corners states of Arizona, New Mexico, Colorado, and Utah is examined. In this area demand is rapidly growing for a limited supply of water due to urban growth, energy development, and Indian tribe claims. Historically agriculture has used 80 to 90% of surface and groundwater for irrigation. While this level of consumption currently remains high the contribution of agriculture the area's economy has sharply declined. It is unlikely that supplies will be substantially increased in the future due to the near exhaustion of good dam sites and water project funding cut backs by the Carter Administration. Many economists, water lawyers, and other observers recommend reallocation of water from less to more economic uses such as away from agriculture and toward cities. Such reallocation would require State legislative action. A survey of voters and legislators showed that both groups are not readily willing to make trade-offs among users. The survey indicated that the voters desired more or the same amount of water for agriculture in the future. Senators want to give the same water to agriculture but also recognize the growing needs of other users. Voter preferences make policy options open to legislators politically difficult or infeasible which probably means that the State legislatures will not take an active role in water policy. Crucial decisions will be left to the courts, the executive, special commissions, and negotiations among interest groups or the market. (Seigler-IPA)
W80-03919

MANAGING A LIMITED RESOURCE: THE POLITICAL CONTRAINTS ON WATER POLICY IN THE FOUR-CORNERS STATES,
Arizona Univ., Tucson.
H. Ingram, N. Laney, and J. R. McCain.
The Utah Law Review, Vol 1979, No 4, p 719-745. 17 Tab, 31 Ref OWRT B-056-ARIZ(2), 14-34-0001-7111

Descriptors: *Water policy, *Water allocation(Policy), *Water supply, *Administration, Colorado, New Mexico, Arizona, Utah, Recreation, Agriculture, Irrigation water, Industrial water, Urbanization, Colorado River Basin, Legislation

The opinions of State senators and voters about water allocation, water scarcity, and related water issues in the Colorado River Basin states of Arizona, Colorado, New Mexico, and Utah are examined and compared. Water policy questionnaires were mailed to a sample of 50 voters, stratified by party registration, in each State legislative district and to State senators in 1975-1976. Presently agriculture is the largest user of western water followed by municipal and industrial uses, minerals, thermal electric uses, and recreation, fish, and wildlife uses. Both senators and voters wish all users to get more water in the future or at least the same proportion of available water. The problem is that in these four states demand is increasing while the physical limits of ground and surface water have nearly been reached. Pressure for more water or reallocation will increase if urban growth continues and energy development occurs. Survey respondents declined to set priorities or to suggest tradeoffs as solutions. Such priorities might be increased water prices for urban water or increased water prices for farm water. While the voters favored more water to agriculture the senators were more sensitive to urban populations. There is little indication that legislators are willing to take either the credit or the blame for water policy decisions and it is likely that they will delegate this responsibility to others if possible. Voters appear somewhat unwilling to accept changes in water policy. This unwillingness to accept change coupled with the lack of legislative incentive make it likely that water policy in the future will be little changed from past or current water policy. (Seigler-IPA)
W80-03920

AN OPTIMAL SAMPLING PROCEDURE FOR THE COLLECTION OF RESIDENTIAL WATER USE DATA,
Johns Hopkins Univ., Baltimore, MD.
S. H. Hanke, and A. Mehrez.
Water Resources Research, Vol 15, No 6, p 1343-1348, December 1979. 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Sampling, *Water users, *Data collections, *Statistics, Water supply, Water demand, Climates, Optimization, Data processing, Statistical methods, Analytical techniques, *Sampling theory, Residential water use.

Sampling theory was used to design an optimal sample of individual residential water users for the United States. The purpose of designing this optimal stratified random sample was to facilitate an efficient nationwide collection of residential water use data which can be analyzed statistically to forecast water use and to determine water system design criteria. This sample was designed in two steps: (1) the specific type and number of customers to be sampled at each location and (2) the specific locations to be sampled. (Sims-ISWS)
W80-03931

COST BEHAVIOR AND WATER SYSTEMS,
West Virginia Univ., Morgantown. Coll. of Business and Economics.
For primary bibliographic entry see Field 6C.
W80-04156

DOMESTIC WATER SUPPLIES, HEALTH AND POVERTY: A BRIEF REVIEW,
R. Feachem.
Water Supply and Management, Vol 2, No 4, p 351-362, 1978. 3 Fig, 31 Ref.

Descriptors: *Domestic water, *Public health, *Water-related diseases, *Diseases, *Water quality, *Rural areas, *Water pollution effects, Poverty, Human diseases, Social aspects, Water purification, Planning, Water supply, Epidemiology, Water quality control.

The magnitude of the world problem of providing adequate domestic water supplies for people is immense and progress at present is slow. Improved domestic water supplies hold out the hope of improved health. The fundamental prerequisite for any understanding of water supplies and health is the classification of water-related infections. These

are: (1) fecal-oral diseases; (2) water-washed diseases; (3) water-based diseases; and (4) water-related insect vector. Studies on the impact on health of domestic water supplies has revealed that there is (1) a wide-spread tendency to fail to demonstrate any marked association between water quality and diarrheal disease; (2) provision of public taps in a community may not itself change hygiene or water use patterns and may not even increase the volume of water used per capita; and (3) where the availability of water is greatly improved a marked reduction in water-related disease may be found. However, installation of improved water supply sources may lead to a reduction of water-borne transmission of the fecal-oral group of diseases without reduction of diseases in the other groups. Investigations into the impact of water supplies are often complex, costly and time consuming. There will clearly be no widespread health benefits unless a country has an efficient and effective rural water program. A major increase in the amount of evaluation work undertaken would be beneficial in promoting improvements in program planning, policy and execution. (Iervolino-NC)
W80-04183

SOME POLICY IMPLICATIONS OF WATER DEVELOPMENT,
Biswas and Associates, Ottawa (Ontario).
A. K. Biswas.
Water Supply and Management, Vol 2, No 3, p 215-226, 1978. 6 Tab, 17 Ref.

Descriptors: *Water development, *Policy, *Political aspects, *Water resources development, *Developing countries, *Decision-making, *Water supply development, Administration, Planning, Water allocation, Water utilization, Agriculture, Industry, Hydroelectric power, Social aspects, Environmental aspects, Water resources, Water management(Administrative).

More and more water will be necessary to satisfy basic human needs because of the continuing increase in world population and the rising standard of living. The quality and quantity of water required to satisfy demands vary considerably depending on type of demand, geographical locations, cultural traditions, standards of living, climatic characteristics and other individual factors. Policy options for uses of water are divided into the following major sectors: rural and urban water supply, water for agriculture, water for industry and hydroelectric power. The social and environmental impacts of water development can be best considered by dividing the effects into three categories of subsystems: physical, biological and human. The physical subsystem includes the hydrologic system, atmospheric system and crusted system. The biological subsystem includes the aquatic ecosystem and the terrestrial ecosystem. The human subsystem is divided into the production system and the sociocultural system. Integrated water management must be insured so that improvement in one sector should not take place at the cost of another. The agricultural sector, which accounts for nearly 80% of the global water consumption, is probably the most inefficient sector and is where most improvements could be made. The problem of water availability in the future is basically a problem of more rational and better management systems. (Iervolino-NC)
W80-04184

MANAGEMENT OF RURAL WATER SUPPLIES,
G. Schultzberg.
Water Supply and Management, Vol 2, No 4, p 333-340, 1978.

Descriptors: *Rural water supply, *Water supply, *Water supply development, *Developing countries, *Water resources development, Administration, Operation and maintenance, Construction, Project purposes, Regional development, Resources, Public health.

In most developing countries rural water programs have emerged from the ministries of health in their efforts to prevent water-borne and water-related diseases. In many countries these programs have remained in the health ministries but in some countries the rural program has been transferred to the urban water supply agency. In other countries rural water supply is seen as a complement to rural development programs and thus is the responsibility of agriculture ministries. Many countries do not have a national target and clearly defined policies for rural water supply development. In place of this is a project-by-project approach which is directed by what external financial and technical resources can be acquired. In the formulation of national programs the following variables are taken into account: (1) priority areas and selection of schemes; (2) level of service to be provided; and (3) participation of the potential beneficiaries and their contribution towards the program. The technology used in the program is often determined by the physical conditions and the options are limited. The choice is between a groundwater or surface-water source; groundwater is generally more reliable. Construction work is carried out with paid laborers or with the help of free self-help labor from the potential beneficiaries. Operation and maintenance problems are ever increasing and are due to under-estimated budget proposals, insufficient allocations and the lack of trained and skilled persons to do the job. Such agencies as UNICEF, WHO and the World Bank have been providing technical and financial assistance to solve these rural water supply programs. In addition to these agencies individual countries such as Sweden, Canada, USA, the Netherlands and West Germany have been making big contributions. (Iervolino-NC)
W80-04185

ENVIRONMENTAL IMPLICATIONS OF WATER DEVELOPMENT FOR DEVELOPING COUNTRIES,
A. K. Biswas.
Water Supply and Management, Vol 2, No 4, p 283-297, 1978. 3 Tab, 30 Ref.

Descriptors: *Environmental effects, *Water resources development, *Water supply development, *Planning, *Project purposes, *Public health, *Water quality, Disease, Ecology, Irrigation effects, Administration, Social aspects, Water supply, Biology, Physical properties, Human diseases, Potable water, Reservoirs.

The environmental implications of water resources development can be divided into three categories of sub-systems: physical, biological and human. The physical sub-system can be further divided into the hydrologic, atmospheric and crustal systems. Water development projects invariably change river and ecosystem regimes; therefore the issue is not whether the environment will be affected but rather how much change is acceptable to society as a whole, and what countermeasures should be taken to keep the adverse changes to a minimum, at a reasonable economic cost. The biological sub-system is divided into the aquatic ecosystem and terrestrial ecosystem. Changing the biological sub-system affects the quality and availability of potable water. This in turn either reduces or increases health hazards such as cholera, typhoid, infectious hepatitis and other water-borne diseases. Water resources developments do not only bring unmitigated benefits; they also often are responsible for unanticipated social costs. Thus in irrigation developments in tropical and semi-tropical regions a secondary effect is the spreading of parasite water-borne diseases because of the creation of favorable ecological environments for these diseases. The impacts of water developments on the human sub-system could be direct or indirect, stemming from direct effects on physical and biological sub-systems. This addition of environmental quality to the traditional objectives of water resources development of economic efficiency and regional income redistribution has made the planning process more complex than ever before. Inclusion of environmental quality as an objective recognizes the fact that the welfare of society has dimensions besides economics; the issue is how it should be incorporated objectively within the planning framework. Planners must give emphasis to the social and environmental consequences of water development projects. (Iervolino-NC)
W80-04186

THE 1976-1977 CALIFORNIA DROUGHT--A REVIEW,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 2E.
W80-04189

6E. Water Law and Institutions

THE POLLUTION CONTROL TAX INCENTIVE: A NON-INCENTIVE,
Missouri Univ., Columbia.
L. A. Nikolai, and R. Elam.
The Accounting Review, Vol 54, No 1, p 119-131, January 1979. 2 Fig, 8 Tab, 13 Ref.

Descriptors: *Pollution taxes(Charges), *Taxes, *Economic efficiency, Certified Pollution Control Facility(CPCF) policy, Regulation, Investment, Return(Monetary), Amortization, Depreciation, Pollution abatement, Equipment, Capital costs, Economics, Government supports.

In 1976 Congress re-enacted the Certified Pollution Control Facility (CPCF) policy under the assumption that federal subsidies in the form of a significant decrease in federal taxes would serve as an incentive to stimulate pollution control investments. However, the present-value federal income tax impact model developed in this study presents substantial evidence that CPCF does not serve as an incentive. In many cases, assuming that firms operate within a 10-20% cost-of-capital range, CPCF does not yield additional present-value tax savings over and above those which would arise from the usual accelerated depreciation deduction and available investment tax credit. Only when the facility has at least a 10-12 yr life for continually profitable manufacturing firm paying no minimum tax, or at least a 14-19 yr life for a manufacturing firm paying no minimum tax, is the CPCF alternative financially attractive. Even then, on an investment of $1 million, maximum tax savings amount to less than $66,000 (or 6.6% of the investment) for profitable firms investing in a facility with a 26 year life. Tax savings are substantially less for a firm in an initial net operating loss position. In addition, due to rapidly improving technology in pollution control equipment, firms will probably prefer shorter-life facilities. Finally CPCF may not be worth the additional paperwork required to obtain certification. (Harris-Wisconsin)
W80-03968

ENVIRONMENTAL PROBLEMS OF DEVELOPING COUNTRIES,
Urban Development Inst., Bombay (India).
R. Mayur.
Annals of the American Academy of Political and Social Sciences, Vol 444, p 89-101, July 1979.

Descriptors: *Environmental control, *Pollution, *Less-developed countries, *India, *Human population, *Adoption of practices, *Social aspects, Environmental effects, Air pollution, Pollution abatement, Water pollution, Urbanization, Human pathology, Diseases, Industrial production, Long-term planning, Planning, US Environmental Protection Agency, Conservation, Forest management, Growth rates, Environment.

A growing world crisis of under-developed countries, in which uncontrolled population growth, urbanization and substandard environmental protection arrangements combine to cause incalculable social misery, is exemplified by India. That country's 635 million population, increasing at an annual 2%, will number 900 million by the end of the century. Per-capita income is $150, only 130 million metric tons of food are produced each year, and only 40% of the population get safe water for drinking and personal hygiene. India's environmental problems include pollution of air and water, cacophonious noise in the cities, and increasing land pollution through uncontrolled solid waste disposal. By the next century, one-third of the population will be living in 5,000 urban settlements and increased industrialization will have intensified environmental problems even beyond today's unthinkable levels. Immediate envi-

ronmental management steps are needed. Recommendations for action include: (1) Decentralization of population growth and industrialization through urban systems planning. (2) Industrial pollution control through government incentives to private firms in the form of financial assistance to purchase and install modern pollution control equipment. (3) Establishment of an Environmental Planning Ministry to function similar to the US Environmental Protection Agency with broad national and state powers. (4) Development of conservation and reforestation movements, including green belt developments around large cities. (5) Establishment of nationwide educational programs to foster environmental ethics. (Harris-Wisconsin)
W80-03969

LIABILITY WITHOUT FAULT UNDER THE FEDERAL WATER POLLUTION CONTROL ACT,
B. Valdez-Ferreira.
Natural Resources Journal, Vol 19, No 3, p 687-692, July 1979.

Descriptors: *Legal aspects, *Federal Water Pollution Control Act, *Oil spills, Penalties(Legal), *Judicial decisions, Legislation, Water Quality Act, Fuels, Gasoline, Tex-Tow, Inc., Marathon Pipe Line Company, Mississippi River, Kaskaskia River, Illinois, Acts of God, Law enforcement, Regulation, Coast Guard regulations.

A legal review is made of two cases heard before the Seventh Circuit Court of Appeals, in which a federal appeals judge reluctantly decided that a river barge line operator and an overland pipeline company were both responsible for civil penalties assessed by the Coast Guard for separate but major oil spills into navigable waters. In 1974, 1600 gallons of gasoline went into the Mississippi River when a tank barge operated by Tex-Tow, Inc. was punctured. The following year 19,992 gallons of crude oil were discharged into the Kaskaskia River in southern Illinois from a pipeline owned by Marathon Pipe Line Company; more than half the oil escaped downriver. Both firms were penalized under Section 1321(b)(6) of the Federal Water Pollution Control Act, by the United States District Court for the Eastern District of Illinois. The appeals court affirmed the earlier finding and held each defendant subject to the civil penalty even though the enterprises were not at fault and the spills were caused by third party acts or ommissions. These cases essentially mean that polluters may be charged with liability without causation; the courts found that substantive due process claim by the defendants had been struck down by the U. S. Supreme Court as early as 1937 (in a price control case). The judges, in summation, found that unjustified penalties such as those imposed on Marathon and Tex-Tow are eventually passed on to the consuming public, but that it is important for polluters to pay for pollution in such large-scale spills. (Harris-Wisconsin)
W80-03971

WOOD PULP, WATER POLLUTION, AND ADVERTISING,
California Univ., Los Angeles. Dept. of History.
J. G. Burke.
Technology and Culture, Vol 20, No 1, p 175-195, January 1979. 5 Tab.

Descriptors: *Pulp and paper industry, *Water pollution sources, *Advertising industry, *Social aspects, *Technology, Lumbering, Industrial wastes, Pulp wastes, Social change, History, Social needs, Social impact, Suspended solids, Industrial production, Waste water(Pollution).

The relationship between the mounting volume of printed advertising in the United States and the increasing pollution of the nation's waters is explored in a study which traces the growth of American advertising in historical context, a perspective which assumes that advertising will continue to flourish and cause increased water pollution levels. Technological progress in the late 19th century created a demand for novel and effective techniques of marketing mass-produced products, and advertising filled this demand as an optimal solution. At the same time, technology in the form of new processes for wood pulping made sufficient quantities of newsprint, paper and paperboard available at low cost to permit the advertising industry to grow and prosper. All this resulted in massive water pollution. Of 61.9 million tons of paper and paperboard produced in the US in 1973, at least 50% was used for advertising and for packaging and shipping advertised products. In 1963 the pulp and paper industry was responsible for 16.7% (3 billion lb) of settleable and suspended solids in all US industrial wastewater. Advertising is thus directly responsible for an additional large percentage. (Harris-Wisconsin)
W80-03972

CULTURAL DIFFERENCES IN PERCEPTIONS OF ENVIRONMENTAL PROBLEMS,
State Univ. of New York at Buffalo. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W80-03973

OFFENSES AGAINST THE ENVIRONMENT AND THEIR PREVENTION: AN INTERNATIONAL APPRAISAL,
G. O. W. Mueller.
Annals of the American Academy of Political and Social Science, Vol 444, p 56-66, July 1979.

Descriptors: *Air pollution, *Water pollution, *International law, *Jurisdiction, *Law enforcement, Environment, Pollutants, Legal aspects, Political aspects, Judicial decisions, United Nations, Regulation, Public rights, Governmental interrelations, Governments, Boundaries(Property).

Little effort has been made to utilize criminal sanctions of international law to control pollution, even though pollutants and their effects do not stop at jurisdictional boundaries. The International Court of Justice at the Hague, a United Nations organ, has no criminal jurisdiction and a United Nations International Criminal Court is not yet fully developed. Therefore, no effective mechanism for international criminal law exists. However, certain pollutiona offenses have become international criminal law by being subjected to universal jurisdiction under national law, such as the negligent release of nuclear energy or dumping pollutants from ships or aircraft into the Mediterranean Sea. Several problems are inherent in using international criminal sanctions in order to control internationally significant environmental pollution: qualification and quantification; strict liability; vicarious liability; corporate liability; proof; abuse of power; inadequate enforcement; changing priorities; trends toward decriminalization; and countervailing penalization policies. Significant pollution is a complicated industrial activity involving a large number of persons with ill-defined responsibilities, thus causing vicarious liability. Difficulties also arise because regulatory provisions are often complex and verbose, if not unintelligible, and therefore enforcement actions take a long time and are often ineffective. (Danovich-Wisconsin)
W80-03977

NEWFOUNDLAND'S CLAIM TO OFFSHORE MINERAL RESOURCES: AN OVERVIEW OF THE LEGAL ISSUES,
Windsor Univ. (Ontario). Faculty of Law.
J. Arvay.
Canadian Public Policy, Vol 1, p 32-44, Winter 1979. 12 Ref.

Descriptors: *Legal aspects, *Federal-state water rights conflicts, *Canada, *Newfoundland, *Continental shelf, Federal jurisdiction, State jurisdiction, Water rights, Political aspects, Ownership of beds, Seashores, Reservation doctrine, Federal government, State governments, Water policy, Natural resources, Resources development.

An overview is presented of legal issues involved in a dispute between Newfoundland Province and the federal Canadian government in regard to disposition and ownership of natural resources lying beneath the sea off Newfoundland's coast. Newfoundland's sovereignty prior to its joining the Canadian Conferenation may not be established by the Canadian Supreme Court. If so, only common law applies, subject to a possible finding that the British Imperial Crown bestowed upon Newfoundland (in its previous status as a Crown Colony) sufficient jurisdiction to establish the colony's proprietary rights over any or all adjacent offshore regions; if Newfoundland's sovereignty prior to its joining the Canadian Confederation is so established, then Newfoundland rather than Canada possesses property and jurisdictional rights. Parliament would retain right to legislate navigation, shipping, fisheries and defense. Alternatives are offered of possible ways to resolve the dispute: (1) Newfoundland would retain property rights to offshore land but plenary jurisdiction over such property would lie with Parliament. (2) The court could regard Newfoundland's pre-Confederation status as irrelevant and conclude that jurisdiction and ownership over offshore lands lies with Canada. Policy considerations rather than jurisprudence alone are likely to be most important in deciding this case. (Harris-Wisconsin)
W80-04150

ENVIRONMENTAL ALTERNATIVES AND SOCIAL GOALS,
DuPont Co., Wilmington, DE.
R. E. Heckert.
Annals of the American Academy of Political and Social Science, Vol 444, p 102-111, July, 1979.

Descriptors: *Environment, *Alternative planning, *Political constraints, *Social values, Social aspects, Political aspects, Decision making, Technology, Value, Regulation, Administration, Governmental interrelations, Institutional constraints, Standards, Costs, Benefits, Economics.

If no imminent threat to public health and safety exists, the preferred way to attain specific environmental goals is to make cost-effective improvements that are affordable, but defer other actions until technology or improved economics permit another cost-effective goal. When considering environmental alternatives, many key decisions involve social issues as much as scientific issues. Technology alone does not solve problems. Value judgements must be made and consensus politics developed if success is to be achieved. A solid consensus is needed on environmental goals. Trade-offs required to implement existing environmental programs and directives are not recognized or are regarded as inconsequential compared with benefits. The current political process involving environmental issues does not thoughtfully consider all relevant data nor allow the flexibility needed to move toward specific objectives. Overlapping responsibilities among agencies dealing with health and environmental problems lead to fragmented consideration of issues with broad impact and failure to look at the totality of regulation. Political and social scientists have an important role in this overall process. (Danovich-Wisconsin)
W80-04157

THE ECOSYSTEM APPROACH; SCOPE AND IMPLICATIONS OF AN ECOSYSTEM APPROACH TO TRANSBOUNDARY PROBLEMS IN THE GREAT LAKES BASIN.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Science Advisory Board.
Special report, July 1978. 47 p, 14 Ref, 1 Append.

Descriptors: *Canada, *International commissions, *International Joint Commission, *Ecosystems, *Water pollution sources, Boundary Waters Treaty of 1909, Great Lakes Water Quality Agreement of 1972, *Great Lakes, Air pollution, Acid rain, Salts, Governments, Legislation, Water policy, Water law, Social aspects, Human population, Ecology.

An approach utilizing a man-in-a-system concept is suggested to replace the system-external-to-man concept inherent in the 1972 Great Lakes Water Quality Agreement between Canada and the United States. Incorporation of the newer approach within advisory and management functions of the two countries would necessitate political

recognition of the Great Lakes Basin as an ecosystem composed of the interacting elements of water, air, land and living organisms including human beings. Problems such as acid rain and harmful chloride concentrations could be better managed by adopting such an approach in the Great Lakes basin. Acid rain is caused by burning of fossil fuels and industrial processing; these activities add sulfur oxides and nitrogen oxides to the atmosphere. In 1970 Canada suffered an estimated $6.8 billion damages exported from the U.S. in the form of acid rain. Approximately 2.8 million metric tons of road salt per year are used in the basin for de-icing, leading to dangerous chloride concentrations in Lake Ontario. In addition, it is thought that an ecosystem approach by both countries might better control current unmanageable population growth in the Great Lakes area, which had 300,000 persons a century ago and 37 million persons today. It is recommended that the U.S. and Canada extend or amend the Boundary Waters Treaty of 1909 and the Great Lakes Water Quality Agreement of 1972 in accordance with the philosophy of ecosystem approach outlined in the paper. (Harris-Wisconsin)
W80-04159

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX C. ANALYSIS OF INSTITUTIONAL ARRANGEMENTS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 5G.
W80-04178

THE BALANCE OF GROUNDWATER RESOURCES OF THE EUROPEAN COMMUNITY: A METHODOLOGY FOR A MULTINATIONAL PROBLEM,
Strasbourg-1 Univ. (France).
For primary bibliographic entry see Field 4B.
W80-04182

MANAGEMENT OF RURAL WATER SUPPLIES,
For primary bibliographic entry see Field 6D.
W80-04185

INTERACTIVE POLLUTANTS AND JOINT ABATEMENT COSTS: ACHIEVING WATER QUALITY STANDARDS WITH EFFLUENT CHARGES,
Newcastle-upon-Tyne Univ. (England). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W80-04187

WEST EUROPEAN INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL POLICY IMPLEMENTATION-ESPECIALLY AIR AND WATER POLLUTION CONTROL,
Akron Univ., OH. Dept. of Urban Studies.
W. R. Mangun.
Environmental Conservation, Vol 6, No 3, p 201-211, Autumn 1979. 32 Ref.

Descriptors: *West Europe, *Policy, *Governments, *Organizations, *Environmental control, Environment, Water pollution, Water pollution control, Air pollution, Institutions, Political aspects, Legislation, Regulation, Law enforcement, Institutional constraints, United Kingdom, Belgium, Denmark, Italy, The Netherlands, West Germany, France, Norway, Sweden, Switzerland.

Basic environmental policy stances, institutional arrangements and implementation approaches of several West European countries are examined. Enactment of new pollution control legislation, accelerated institutional innovation and agency reorganization throughout West European countries in the 1960s and 1970s led to an ever-increasing enforcement burden. However, no solution common to all countries tackles this problem. Some countries created new and independent agencies such as the United Kingdom's Department of the Environment. Other countries simply reorganized existing agencies. This pattern developed with the Ministry of the Interior in West Germany and in the Ministry of Public Health and Environmental Hygiene in the Netherlands. Other countries, such as Italy, did not substantially alter their organizational structure to deal with environmental problems. Pollution control approaches varied significantly. Some countries, such as Sweden, adopted comprehensive pollution-control policies which cover all basic areas: air, water and land. Other countries, such as the United Kingdom and West Germany, developed vigorous air pollution control policies while France developed strong water pollution control. In most countries, policy development was incremental, with expansion and improvement of basic pollution control laws. Countries examined were: United Kingdom, West Germany, The Netherlands, Italy, France, Norway, Sweden, Switzerland, Belgium, and Denmark. (Danovich-Wisconsin)
W80-04200

7. RESOURCES DATA

7A. Network Design

DESIGN OF OPERATIONAL PRECIPITATION AND STREAMFLOW NETWORKS FOR RIVER FORECASTING,
GKY and Associates, Inc., Alexandria, VA.
R. U. Jettmar, G. K. Young, R. K. Farnsworth, and J. C. Schaake, Jr.
Water Resources Research, Vol 15, No 6, p 1823-1832, December 1979. 7 Fig, 8 Ref.

Descriptors: *River forecasting, *Network design, *Precipitation(Atmospheric), *Streamflow, *Pennsylvania, Model studies, Hydrograph analysis, Gaging stations, Watersheds(Basins), Operations, River basins, Methodology, Mathematical models, Networks, Time lag, Hydrographs, *Susquehanna River Basin(PA), Gage density.

A methodology is presented for assessing the value of river forecasting to possible changes in existing precipitation and streamflow networks. This study was undertaken as a part of an effort to evaluate the expected benefit of automating all or part of the data-gathering networks used by the National Weather Service. A surrogate measure of benefits, called the 'mean forecast lead time,' is related indirectly to benefits because the value of river forecasting depends on the lead time available for the flood plain dweller to take action and respond to the forecast. Presented was the rationale for the methodology and the results of part of the research using streamflow generated by Hurricane Agnes (June 1972) and Hurricane Eloise (September 1975) for the Susquehanna River basin. The methodology can be used to analyze the issues of network design including gage density, automation, gage down time, network timing relationships, effects of rain forecasts, and model and other sources of error. The method can be used to evaluate existing networks. Given network and modeling automation, the method can be used to automatically select the network response time. It was recommended: A more detailed analysis and investigation of the Susquehanna data base should be undertaken. The linkage to benefits should be extended and pinned down with an objective of direct benefit estimates being generated as functions of network design parameters. The methodology should be generalized to the current generation of state-of-the-art conceptual rainfall-runoff models being introduced within NWS. An analysis should be conducted with the methodology on sufficiently general data sets to enable the generation of network design guidelines and criteria. (Humphreys-ISWS)
W80-03939

SAMPLING OF INTERRELATED RANDOM FIELDS: THE RAINFALL-RUNOFF CASE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
R. L. Bras.
Water Resources Research, Vol 15, No 6, p 1767-1780, December 1979. 16 Fig, 2 Tab, 18 Ref.

Descriptors: *Hydrology, *Sampling, *Stochastic processes, *Network design, Reviews, Model studies, Forecasting, Hydrograph analysis, Mathematical models, Rainfall, Discharge(Water), Runoff, Watersheds(Basins), Rainfall disposition, Streamflow, Flood forecasting, Networks, Peak discharge, Gage density.

The rainfall-runoff process is the most common vector-valued random field studied by hydrologists. A historical review of four articles dealing with the sampling of this multivariate problem is presented. Ideas on new formulations to study the sampling needs for rainfall-runoff modeling are given. The main goal was to illustrate the development of ideas from a deterministic, linear frequency domain approach to a nonstationary, nonlinear treatment of random fields. The state of the art is encouraging, but a lot remains to be done. Areas of needed theoretical improvements are identified, and ideas on future approaches suggested. (Humphreys-ISWS)
W80-03940

CONSIDERATIONS FOR THE DESIGN OF A HYDROLOGIC DATA NETWORK USING MULTIVARIATE SENSORS,
National Weather Service, Fort Worth, TX. Southern Region.
K. C. Crawford.
Water Resources Research, Vol 15, No 6, p 1752-1762, December 1979. 5 Fig, 2 Tab, 34 Ref, 1 Append. BOR 6-07-DR-20050.

Descriptors: *Network design, *Hydrologic data, *Model studies, *Sampling, Rainfall, Mathematical models, Statistical models, Meteorological data, Rain gages, Stations, Networks, Statistical methods, Spatial distribution, Temporal distribution, Analytical techniques, Algorithms, Sensor location, Gage density.

An experimental design model has been developed to evaluate trade-offs involved in the optimal sampling of surface rainfall. The model reveals that deployment of statistically adequate sensor arrays depends critically on the storm physics, the sensor engineering aspects, and the procedure chosen for analysis of information from the deployed network. The model was used to examine the effect of sensor density reduction on the ability of a sampling system to detect signal variation. Predictand-related sensors were shown to be essential to network design. Options in multivariate sensor deployments (spatial and temporal) are explained. Deployment along and across a preferred storm track is related to convective system anisotropy, rain gage density, temporal sampling intervals, availability of radar data, and interrelationships among the multivariate predictor data sets. Any proposed sensor array was shown to represent a balance between the demands of economy and climatology. A maximum of 10 gage sensors within the coherent convective storm area is sufficient to fully explain and sample the significant signal variance of a representative High Plains convective system. A reasonably accurate surface rainfall analysis is possible using gage sensors spaced 60 sq km/gage. An equivalent analysis is obtained from good radar data and a gage density of 190 sq km/gage. Analysis accuracy in the gage network is improved only 10% when the gage density is increased to 50 sq km/gage. Quality radar data combined with gage information spaced 50 sq km apart produce 65% less sampling error variance than observed in the best sampling from gage information alone. (Humphreys-ISWS)
W80-03941

STATISTICAL CONSIDERATIONS IN NETWORK DESIGN,
Stanford Univ., CA.
P. Switzer.
Water Resources Research, Vol 15, No 6, p 1712-1716, December 1979. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Network design, *Statistical methods, *Stations, Mathematical studies, Systems analysis, Spatial distribution, Variability, Monitoring, Analytical techniques, Statistics, Error calculations.

After discussing general considerations on the importance and unimportance of optimization in spa-

tial network design, the author indicated how one might exploit spatial autocorrelations and covariate information. It was pointed out that spatial autocorrelations themselves require care in their estimation. Two illustrations showed how probabilistic error calculations are made for mapping problems using network station data. One illustration used a quantitative mapping variable, and the other used a qualitative mapping variable. (Humphreys-ISWS)
W80-03942

DENSE NETWORKS TO MEASURE CONVECTIVE RAINFALL IN THE SOUTHWESTERN UNITED STATES,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
H. B. Osborn, K. G. Renard, and J. R. Simanton.
Water Resources Research, Vol 15, No 6, p 1701-1711, December 1979. 11 Fig, 4 Tab, 13 Ref.

Descriptors: *Networks, *Rainfall disposition, *Demonstration watersheds, *Arizona, *New Mexico, Sampling, Rain gages, Watersheds(Basins), Hydrologic data, Areal, Measurement, Spatial distribution, Rainfall, Thunderstorms, Analysis, Analytical techniques, Depth-area curves, Distribution patterns, Isohyets, Correlation analysis, Runoff, *Walnut Gulch(AZ), *Alamogordo Creek(NM), Dense networks, Rain gage networks.

Almost all rangeland runoff in the southwestern United States results from intense short duration rainfall of limited area extent. In 1953, two southwest rangeland watersheds, the 150-sq km Walnut Gulch and 174-sq km Alamogordo Creek watersheds, were selected as outdoor laboratories to measure water yield from rangeland watersheds. The networks were planned initially with gages on a 1-mi grid, but difficulties in access resulted in more uneven networks, and the basic networks were not completed until 1961. Gages were added after 1961, both for better estimates of rainfall on very small intensive study areas and to fill 'gaps' in the original network. Summer storms in eastern New Mexico where frontal convective thunderstorms occur can have greater areal extent and point rainfall maximums. The simple correlation for total thunderstorm rainfall between pairs of gages decreases very rapidly with increasing distance between the gages. On the basis of the Walnut Gulch and Alamogordo Creek data, for r = 0.4 the gages could be 5 and 10 km apart, respectively. For a simple correlation of 0.9 the gages should be 0.9 and 1.3 km apart, respectively, suggesting rain gage networks of 230 and 100 gages, respectively. Gage networks that differentiate from the hypothetical network can lead to serious overestimates or underestimates of the rainfall volume for a given watershed. The isohyetal maps constructed using different networks illustrated the magnitude of the difference at Walnut Gulch. For air mass thunderstorms, relatively closely spaced gages (about 6 km, r = 0.2, on Walnut Gulch) can be assumed to be independent sampling points for determining recurrence intervals of extreme values. Estimates of the rainfall energy factor R of the universal soil loss equation (USLE) require closer spacing of the gages than does a rainfall estimate alone. Thus for erosion research on small watersheds (10 ha or less) the gage should be within or very near the area. (Humphreys-ISWS)
W80-03943

DEVELOPMENT OF HYDROMETRIC NETWORKS IN BRITISH COLUMBIA,
Water Survey of Canada, Vancouver (British Columbia).
W. L. Kreuder.
Water Resources Research, Vol 15, No 6, p 1677-1686, December 1979. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Networks, *Hydrologic data, *Canada, *Network design, Stream gages, Gaging stations, Regional analysis, Streamflow, Hydrology, Drainage area, Data collections, Sampling, *British Columbia.

The growth and purposes of the Water Survey of Canada's British Columbia network were described from a practical point of view, tracing the progress toward a rational data gathering system. The network consists of several subnetworks of which three, the regional, the major stream, and the national inventory, were described in detail. As the major stream and national networks are reasonably simple in purpose and operation, the major part of the discussion was concerned with the regional network whose main purpose is the transfer of information. To meet this purpose and to analyze the performance of the network, certain procedures for the organization of data have been employed. These procedures included data banks for both hydrologic quantities and grid square extracted physiographic characteristics and regression analysis for relating the quantities in these data banks. The discussion outlined the British Columbia experience of sampling and transferring data in a diverse and primarily mountainous terrain. (Humphreys-ISWS)
W80-03944

MEASUREMENTS OF RAINFALL INTENSITY, INSTRUMENTATION AND DATA PROCESSING,
Forsvarets Forskningsanstalt FOA, Stockholm (Sweden).
For primary bibliographic entry see Field 2B.
W80-04028

DIMENSIONALITY PROBLEMS IN WATER QUALITY NETWORK DESIGN,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier.
Water Resources Research, Vol 15, No 6, p 1692-1700, December 1979. 35 Ref.

Descriptors: *Water quality, *Network design, *Sampling, *Methodology, Reviews, Networks, Analytical techniques, Variability, Design, Stochastic processes, Statistical methods, Monitoring, Time series analysis, Kriging, State estimate theory.

Dimensionality problems in design of water quality networks arise from the multiple variables measured, which may be generated by different physical, chemical, and biological processes, and from the multiple spatial and temporal dimensions of the processes generating the measurements. The problem is further complicated by the range of objectives which a network may be required to meet. The designer is almost inevitably constrained by budget considerations to employ the same network to measure an array of variables, often for more than one objective. These considerations serve to pose serious difficulties in arriving at an analytical formulation of the problem, far less to solve it, with the result that almost all existing water quality networks have been designed on an ad hoc basis. Although no one approach is likely to be universally applicable, several techniques have been employed in particular situations. Included are state estimation, time series analysis, probability theory, and the theory of regionalized variables. Several promising applications of these techniques to water quality network design were reviewed. Few of the approaches reviewed, however, are amenable in present form to solution of practical multivariate design problems. What is needed now is a regrouping, with a closer eye toward applications, especially in light of the multidimensional nature of the network design problems faced in meeting the needs of water quality data users. (Humphreys-ISWS)
W80-04041

WATER QUALITY SAMPLING: SOME STATISTICAL CONSIDERATIONS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Mathematical Sciences.
A. M. Liebetrau.
Water Resources Research, Vol 15, No 6, p 1717-1725, December 1979. 10 Fig, 1 Tab, 30 Ref. USGS 14-08-0001-G-432.

Descriptors: *Water quality, *Sampling, *Network design, *Maryland, *Watersheds(Basins), Monitoring, Statistical methods, Statistical models, Analytical techniques, Stations, Networks, Biochemical oxygen demand, Dissolved oxygen, Variability, Probability, Analysis, Mathematical models, *John Falls(MD), Sequential methods.

Typically, a state, regional, or national water quality (WQ) monitoring system has many objectives. Examples include (1) providing a systemwide synopsis of WQ; (2) determining whether selected WQ parameters show gradual changes over time; (3a) detecting actual or potential WQ problems, (3b) determining the specific causes of actual problems, and (3c) assessing the effect of any corrective action; and (4) enforcing the law. While these purposes have different data requirements, they are interrelated, and data collected for any one can have value for others; for example, data collected for the listed reasons could be used for future long-range planning. Each objective makes certain demands of a WQ sampling network, and these in turn have implications concerning sampling design and statistical analysis of resulting data. In a sampling scheme flexible enough to encompass multiple objectives, data sets collected for answering questions arising under points 1-4 need not all have similar characteristics; consequently, a variety of statistical methods are needed. A good sampling design is important for achieving the first two objectives. A working definition of 'water quality' was given initially, and this was followed by the definition of a sampling population. The set of all segments of the drainage network serves as the population for several sampling plans. In particular, the use of probability sampling to design a network of synoptic sampling stations was discussed in detail. Finally, sequential statistical procedures were applied to a specific problem of type 3c. In terms of the amount of data required, sequential methods are quite efficient for detecting changes of a specified magnitude in some WQ parameter. (Humphreys-ISWS)
W80-04042

THE WORTH OF HYDROLOGIC DATA,
Dames and Moore, Washington, DC.
D. R. Dawdy.
Water Resources Research, Vol 15, No 6, p 1726-1732, December 1979. 1 Fig, 1 Tab, 39 Ref.

Descriptors: *Hydrologic data, *Network design, *Value, Decision making, Streamflow, Precipitation(Atmospheric), Variability, Economics, Stochastic processes, Costs, Sampling, Networks, Stations.

The collection of data implies a use and a worth for those data. The first data to be collected usually contain the most information and have the most worth. As more data are collected, their marginal worth decreases, whereas their marginal cost usually does not do so, or at least not to the same extent. Therefore an optimal network design would have the configuration which either (1) has the maximum worth for a given budget or (2) has a design such that the marginal worth of data is equal to its marginal cost. In principle, the optimal design is thus conceptually simple. However, in practice, the cost of data is obtainable, though usually with some difficulty and uncertainty. Worth, in economic terms, is much more difficult to assess. Optimal design of data networks requires a measure of the worth of data. Worth is use specific and difficult to measure. Surrogates to worth, usually some measure of accuracy, have been developed. These surrogates and attempts to translate them to economic measures are discussed. Advances toward realism make solutions more difficult. Simplicity of solution and ease of understanding are required if methods developed are to have any impact on decision makers. (Humphreys-ISWS)
W80-04043

THE WORTH OF HYDROLOGIC DATA FOR NONOPTIMAL DECISION MAKING,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6B.
W80-04044

NETWORK DESIGN USING OPTIMAL ESTIMATION PROCEDURES,
Institute of Hydrology, Wallingford (England).
D. A. Jones, R. J. Gurney, and P. E. O'Connell.
Water Resources Research, Vol 15, No 6, p 1801-1812, December 1979. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Network design, *Rainfall, *Mathematical models, *Sampling, Networks, Stations, Rain gages, Model studies, Mathematical studies, Statistical methods, Analytical techniques, Rainfall disposition, Estimating, Optimization, Correlation analysis, Theoretical analysis, Gaging stations, Areal, Error estimation.

A network of rain gages provides information about rainfall at only a limited number of points within a region: some procedure must then be adopted to estimate the rainfall for other chosen points and areas within the region. Methods were presented whereby the accuracy of rainfall estimates can be quantified so that a comparison with the requirements of users of rainfall data can be made. The calculation of the accuracy of optimal estimates based on any number and configuration of gages was described. The results can be applied to the redesign of existing networks of gages by mapping the root mean square error of point interpolation, allowing the identification of those areas where new gage sites are most needed to meet some specified criterion of accuracy. Formulae were also presented which allow the accuracy of an optimal estimate of areal rainfall to be calculated for any shape of area and any configuration of gages. (Humphreys-ISWS)
W80-04045

A CASE STUDY OF RATIONALIZATION OF A RAIN GAGE NETWORK IN SOUTHWEST ENGLAND,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2B.
W80-04046

KRIGING IN THE DESIGN OF STREAMFLOW SAMPLING NETWORKS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
J-P. Villeneuve, G. Morin, B. Bobee, D. Leblanc, and J-P. Delhomme.
Water Resources Research, Vol 15, No 6, p 1833-1840, December 1979. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Sampling, *Streamflow, *Network design, *Model studies, Mathematical models, Analytical techniques, Statistical methods, Discharge(Water), Data processing, Stochastic processes, Gaging stations, Estimating, Optimization, Variability, Spatial distribution, Frequency, Ungaged sites.

Kriging is of particular interest in network design because of its ability to estimate streamflow values using existing stations. Another possibility offered by kriging is the estimation of variance reduction gained by addition of fictitious stations in regions of high variance. A brief description was given of kriging theory as developed at the Ecole des Mines de Paris. In order to improve and optimize the Quebec streamflow recording network design the authors kriged specific streamflows with a given return period over the Quebec province, using the data observed at existing stations. For the evaluation of the given return period flow and its sampling variance at each gaged site the authors used the log Pearson type 3 distribution model. Kriging is an optimal estimation technique, in terms of minimum variance, and contrary to other methods it gives an estimation variance for any point in the kriged domain, which is essential in network design. Network analysis and optimization are presently expensive and time-consuming undertakings. In this study of flows with given return periods, the authors demonstrated the aptitude of kriging to transpose information from gaged to ungaged sites and showed how the different elements of kriging can be used for network design. (Humphreys-ISWS)
W80-04047

USE OF PRINCIPAL COMPONENT ANALYSIS TO IDENTIFY HOMOGENEOUS PRECIPITATION STATIONS FOR OPTIMAL INTERPOLATION,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
G. Morin, J. P. Fortin, W. Sochanska, J. P. Lardeau, and R. Charbonneau.
Water Resources Research, Vol 15, No 6, p 1841-1850, December 1979. 10 Fig, 4 Tab, 10 Ref.

Descriptors: *Precipitation(Atmospheric), *Networks, *Stations, *Watersheds(Basins), Analytical techniques, Optimization, Spatial distribution, Correlation analysis, Theoretical analysis, Data processing, Statistical methods, Seasonal, Winter, Spring, Summer, Autumn, Homogeneity, Sampling, Canada, *Eaton River(Quebec), Interpolation, Principal components.

The Eaton River precipitation network was set up as one of the Quebec International Hydrologic Decade projects in 1965. At the end of the decade, in 1975, 30 stations had been in operation for most of the period in this 248-sq mi basin. After a principal components analysis of the data from 14 of the 30 stations on 10-day precipitation totals, it was found that the stations could be divided into three groups, the composition and geographic distribution of which change from season to season. It was also possible to identify which stations were redundant and could be closed should it become necessary. Application of optimal interpolation, season by season, to a 30- and a 5-station network showed that the precision of point interpolation varies more from season to season for the same network than from the 30- to the 5-station network for the same season. In fact, errors of interpolation caused by microclimatic irregularities and by observational errors in the initial data are greater than those resulting from the reduction of the network from 30 to 5 stations. (Humphreys-ISWS)
W80-04048

TERMINATION OF HYDROLOGIC DATA COLLECTION (A CASE STUDY),
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 6B.
W80-04049

A STATISTICAL APPROACH TO STATION DISCONTINUANCE,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04050

7B. Data Acquisition

NON-POINT SOURCE SEDIMENTATION STUDIES USING INFRARED REMOTE SENSING,
Maine Univ. at Orono.
For primary bibliographic entry see Field 5B.
W80-03923

RAINFALL MEASUREMENTS BY WEATHER RADAR: APPLICATIONS TO HYDROLOGY,
Research Council of Alberta, Edmonton. Atmospheric Science Div.
B. L. Barge, R. G. Humphries, S. J. Mah, and W. K. Kuhnke.
Water Resources Research, Vol 15, No 6, p 1380-1386, December 1979, 10 Fig, 21 Ref.

Descriptors: *Radar, *Flood forecasting, *Rainfall, Weather, Precipitation(Atmospheric), Rain, Hydrology, Rain gages, Areal, Data storage and retrieval, *Weather radar, *Rainfall measurements, *Alberta(Canada), Surface precipitation, Data management, Digital radar, Backscatter, Areal rainfall.

Surface precipitation measurements were improved by using both weather radar and conventional rain and snow gages. Advances in digital radar data management made possible improved precipitation estimates for hydrological applications such as flood forecasting. A project undertaken in Alberta provided areal precipitation data for operational flood forecasting. Maps depicting rainfall intensities were generated at specified time intervals from the Alberta Research Council's S band weather radar. Transmitted 150 km by telecopier to the Flow Forecasting Branch, Alberta Environment, the real-time radar-derived areal maps of precipitation were used with point surface observations to specify more precisely the precipitation events that led to floods. During precipitation events, weather radar data provided an indication of the applicability of point surface observations, which led to better operational flow forecasts. Radar measurements of rainfall intensity and rainfall amount were found to be of considerable benefit to operational and applied hydrologists. (Roberts-ISWS)
W80-03929

A STOCHASTIC DESCRIPTION OF WET AND DRY SPELLS IN TERMS OF AN EFFECTIVE NUMBER OF DAYS,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 6A.
W80-03938

MULTIDATE LANDSAT LAKE QUALITY MONITORING PROGRAM,
Wisconsin Univ., Madison.
L. T. Fisher, F. L. Scarpace, and R. G. Thomsen.
Photogrammetric Engineering and Remote Sensing, Vol 45, No 4, p 519-527, April 1979. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Lakes, *Data storage and retrieval, *Remote sensing, *Water quality, *Trophic level, Wisconsin, Data collections, Satellites(Artificial), Mapping, Data processing, Data transmission, Computer programs, Landsat, Eutrophication, Monitoring, Navigation, Computers.

A remote sensing program by Earth satellite (Landsat) is described in which multidate scanning procedures are used to monitor water quality parameters and classify approximately 3,000 Wisconsin lakes larger than 20 acres. To cope with the major data collection problems involved in a process of this scope, unified files and programs were developed to automate and systematize data handling. Three files are described: One is a link-listed file structured to permit considerable processing versatility, containing latitude-longitude based polygons which delimit each lake. A second file is built up gradually as many Landsat scenes are processed, and allows storage of extracted data. A third file contains control point coordinates from throughout the state. Software consists of three programs. The first locates control points so that satellite coordinates can be measured for scene navigation. A second program produces navigation constants. A third locates all lakes covered by a Landsat scene and extracts data for storage in a statistical summary. Use of Landsat data means that ground coordinates can help identify irregularly shaped areas which can be repeatedly accessed. The method allows exploitation of Landsat's repeated coverage. (Harris-Wisconsin)
W80-04118

MARS - A NEW INSTRUMENT FOR MEASURING PHYTOPLANKTON SINKING RATE,
Oceanic Inst., Waimanalo, HI.
G. N. Rothwell, and P. K. Bienfang.
Marine Technology Society Journal, Vol 12, No 5, p 13-17, October-November 1978. 7 Fig, 5 Ref.

Descriptors: *Phytoplankton, *Settling velocity, *Instrumentation, Equipment, Depth, Sinks, Population, Measurement, Cytological studies, Tracers, Tagging, Radioisotopes, Movement, Eutrophication.

The MARS (Multichannel Assembly for Radioplankton Sinking) technique is based on detection of the radioactive isotope C-14 which is assimilated by cells during a procedure used to determine production rates. Phytoplankton are radioactively labeled by adding C-14-bicarbonate to seawater

samples and allowing cells to take up C-14 by photosynthesis during an incubation period. After incubation, a subsample is placed as a discrete layer upon the surface of a seawater column. Labeled cells sink to the bottom, while the C-14 solution remains in the surface sample. Labeled cells are detected by Geiger-Muller systems and the phytoplankton's sinking rate is calculated. A MARS apparatus consists of a teleprinter, gas flow meter, high voltage power supply, micro-processor controller, gas supply, GM chamber chassis, motorized syringe and gimbal frame for damping ship motions. A typical time-course distribution from a sinking rate trial shows background counts; positive slope area marking arrival of labeled cells; and a plateau region reflecting decreased arrival rates when all but the slowest-sinking cells have reached the bottom. The mean cell population sinking rate is then calculated by an equation based upon numerical integration of the population arrival rate. The MARS system has been operated during two ocean cruises and has been extensively used in laboratories; trials produce reliable sinking rate measurements. (Danovich-Wisconsin)
W80-04142

7C. Evaluation, Processing and Publication

WATER RESOURCE USES AND ISSUES IN TEXAS,
Texas Agricultural Experiment Station, College Station.
J. G. McNeely, and R. D. Lacewell.
Report B-1189, August 1978. 52 p, 4 Fig, 6 Tab, 61 Ref. 12 Photos.

Descriptors: *Texas, *Water resources, *Management, *Surface waters, *Groundwater, Planning, Water utilization, Water management(Applied), Aquifers, Droughts, Water quality, Water conservation, Agriculture, Estuaries, Reservoirs, Water yield, Industrial water, Municipal water, Water policy, *Ogallala Aquifer(TX), *Gulf Coast Aquifer(TX), *Edwards Aquifer(TX).

The purpose of this report was twofold--to review the current status of water resources in Texas relative to institutions and incidence of availability and use and to address some important water resource issues facing the state. Water resources to meet agricultural, municipal, industrial, and residential demands are taken from groundwater and surface water sources. Texas has a long-term annual availability of fresh water from ground and surface sources combined of at least 14.1 million acre-feet (maf). This includes a safe groundwater yield of 5.1 maf, defined as the quantity of average, annual recoverable recharge to groundwater aquifers. It also includes a firm surface water yield of at least 9.0 maf, defined as 'the quantity of water that can be withdrawn or released from reservoirs continuously, on an annual basis, over periods of time of sufficient length so as to span the most severe period of drought in the reservoir catchment areas.' Annual groundwater overdraft is lowering water tables, increasing pumping costs, and affecting the physical characteristics of individual aquifers. A landowner in Texas owns the groundwater beneath his land and has the right to drill wells and appropriate all of the underground percolating waters generally without regard to the effect upon other landowners. Two basic doctrines of surface water rights recognized in Texas are the riparian doctrine and the appropriation doctrine. The Texas Gulf Coast has ten estuarine systems scattered from Louisiana to Mexico. The legislature is expected to make some basic policy decisions concerning the estuarine resources. Agriculture, in contrast to manufacturing and most other uses, consumes a large part of its water withdrawals. The development of Texas has exacted a high price in the deteriorating quality of its water resources. Rivers, lakes, and coastal waters have been heavily damaged by the discharge of waste, by polluted runoff from urban, agricultural, and resource development, and by accelerated erosion and sedimentation. A strategy to achieve cleaner waters and reduce the production of unnecessary pollutants is now under way. (Humphreys-ISWS)
W80-03933

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1978--VOLUME 1. ARKANSAS RIVER BASIN.
Geological Survey, Oklahoma City, OK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143829, Price codes: A23 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OK-78-1, September 1979. 523 p, 8 Fig.

Descriptors: *Oklahoma, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Arkansas River basin.

Water resources data for the 1978 water year for Oklahoma consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes or reservoirs. Volumes 1 and 2 of this report contain discharge records for 120 gaging stations; stage and contents for 27 lakes or reservoirs; water quality for 121 gaging stations, 3 lakes, and 76 wells; and water levels for 48 wells. Also included are 42 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (Kosco-USGS)
W80-04083

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1978--VOLUME 2. RED RIVER BASIN.
Geological Survey, Oklahoma City, OK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143001, Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OK-78-2, September 1979. 249 p, 8 Fig.

Descriptors: *Oklahoma, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Red River basin(Okla).

Water resources data for the 1978 water year for Oklahoma consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes or reservoirs. Volumes 1 and 2 of this report contain discharge records for 120 gaging stations; stage and contents for 27 lakes or reservoirs; water quality for 121 gaging stations, 3 lakes, and 76 wells; and water levels for 48 wells. Also included are 42 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (Kosco-USGS)
W80-04084

WATER RESOURCES DATA FOR NORTH DAKOTA, WATER YEAR 1978.
Geological Survey, Bismarck, ND. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126253, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ND-78-1, September 1979. 774 p, 6 Fig.

Descriptors: *North Dakota, *Hydrologic data, *Surface waters, Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 153 gaging stations; stage only records for 16 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 76 gaging stations, 12 partial-record stations, 25 lakes, 97 wells, and water levels for 32 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in North Dakota. (Kosco-USGS)
W80-04085

HYDROLOGIC DATA FROM SELECTED WELLS IN THE HELENA VALLEY, LEWIS AND CLARK COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-04090

WATER-QUALITY ASSESSMENT OF RATTLESNAKE CREEK WATERSHED, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5A.
W80-04091

URBAN STORMWATER DATA MANAGEMENT SYSTEM WITH APPLICATIONS TO SOUTH FLORIDA STUDIES,
Geological Survey, Orlando, FL. Water Resources Div.
R. A. Miller, W. H. Doyle, Jr., and L. D. Wilson.
Geological Survey Water-Resources Investigations 79-93, July 1979, 113 p, 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Urban hydrology, *Urban runoff, *Storm water, *Model studies, *Computer models, Data collections, Precipitation(Atmospheric), Storm runoff, Storm drains, Data storage and retrieval, Computer programs, Surface waters, Water quality, Florida, *South Florida, *Fortran.

A data management system was developed to store and retrieve urban stormwater data collected from four small urban basins in south Florida. The system is event oriented in that all data from one storm are stored together on the computer file. The data include descriptive information about the storm and data on rainfall, stage, discharge, and water quality. The data management system, composed of about 20 Fortran programs, was developed to store data, retrieve tables for publication, calculate flow discharges and constituent loads, and provide for interfacing with statistical and deterministic model application programs. (Kosco-USGS)
W80-04097

GEOHYDROLOGIC DATA FOR THE BEAVER-PASQUISET GROUND-WATER RESERVOIR, RHODE ISLAND,
Geological Survey, Providence, RI. Water Resources Div.
D. C. Dickerman, and H. E. Johnston.
Rhode Island Water Resources Board Water Information Series Report 3, 1977. 128 p, 18 Fig, 1 Plate, 21 Tab, 13 Ref.

Descriptors: *Hydrologic data, *Rhode Island, *Groundwater resources, *Data collections, Sites, Aquifer characteristics, Stratigraphy, Planning, Water resources development, Water levels, Water yield, Test wells, Lithologic logs, Particle size, Sampling, Water analysis, Seismology, Resistivity, Surface waters, Water quality, Low flow, Discharge measurement, Chemical analysis, Pumping, Observation wells, *Beaver-Pasquiset groundwater reservoir, *Pawcatuck River basin, Charlestown moraine, Stratified-drift deposits.

Geohydrologic data were collected in a 16.9 square-mile study area in southern Rhode Island, which includes the Beaver-Pasquiset ground-water reservoir. The data, which are mainly limited to the stratified-drift aquifer, are presented in tabular form and are being used by the Rhode Island Water Resources Board in planning and developing the ground-water resources of the Pawcatuck River basin in southern Rhode Island. The data include descriptions of the depths, yields, and construction features of 230 selected wells and test holes; lithologic logs of 110 wells and test holes; particle-size distribution for 300 lithologic samples; description of 8 aquifer tests; velocity and layer thickness at 41 seismic shot points; apparent resistivity at 9 sites; water-level data; surface-water-quality data; low-flow discharge measurements; and stream discharge data. Chemical analyses of water samples from 69 selected wells and test holes are also included. The location of data-collection sites and the area underlain by stratified-drift deposits are shown on a two-part plate on a 1:12,000 scale topographic base map. Figures show the location of aquifer test sites, pumping wells, observation wells, and generalized lithologic logs of wells. (Kosco-USGS)
W80-04098

MULTIDATE LANDSAT LAKE QUALITY MONITORING PROGRAM,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 7B.
W80-04118

8. ENGINEERING WORKS

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QUALITY AND TREATMENT OF WATER INVOLVED WITH COAL SLURRY TRANSPORT BY PIPELINE,
Missouri Univ.-Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 5D.
W80-04108

8B. Hydraulics

STABILIZED SAND SURFACES FOR OVERLAND FLOW STUDIES,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
For primary bibliographic entry see Field 2E.
W80-03945

8I. Fisheries Engineering

IMPACT OF AN INTRODUCED FISH SPECIES (MORONE AMERICANA) ON THE FISHERIES RESOURCES OF NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W80-04109

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

URBAN STORMWATER DATA MANAGEMENT SYSTEM WITH APPLICATIONS TO SOUTH FLORIDA STUDIES,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04097

10D. Specialized Information Center Services

PROGRAM OBJECTIVES FOR THE NATIONAL WATER DATA EXCHANGE (NAWDEX) FOR FISCAL YEAR 1980,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Available from: OFSS Bx 25425 Fed. Ctr. Denver, CO paper copy $1.00 microfiche $3.50. Geological Survey open-file report 80-11, 1979. 6 p.

Descriptors: *Information exchange, *Programs, *Planning, *Management, *Hydrologic data, Data storage and retrieval, Systems analysis, Indexing, Training, *National Water Data Exchange(NAWDEX), Water data sources.

This report describes the proposed program objectives of the National Water Data Exchange (NAWDEX) for fiscal year 1980. These include NAWDEX program administration, NAWDEX services, water-data indexing activities, systems development, training, and the development of recommended methods for the handling and exchange of water data. (Kosco-USGS)
W80-04088

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 13
JULY 1, 1980

W80-04201 -- W80-04500
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 13
JULY 1, 1980

W80-04201 - W80-04500

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER

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02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

CHARACTERIZATION AND MODELS OF WATERSHED STORAGE,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04233

GROUNDWATER TRANSPORT OF A SALT TRACER THROUGH A SANDY LAKEBED,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
D. R. Lee, J. A. Cherry, and J. F. Pickens.
Limnology and Oceanography, Vol 25, No 1, p 45-61, January 1980. 13 Fig, 2 Tab, 35 Ref.

Descriptors: *Mass transfer, *Groundwater movement, *Tracers, *Lakes, *Salts, *Surface-groundwater relationships, *Canada, Dispersion, Advection, Lake beds, Permeability, Shores, Seepage, Sediment-water interfaces, Lake bottom springs, Numerical analysis, Sampling, Electrical conductance, Anisotropy, Hydraulic conductivity, Groundwater transport.

In an investigation of groundwater advection and dispersion in a lakebed, a vertical zone of salt solution was injected between 1.7 and 3 m beneath the shoreline and entered the lake through a large area of lakebed at a reduced concentration. Migration of the tracer pulse and flux to the lake were monitored over a 7 x 8 m area of lakebed by measuring the electrical conductance of water collected from sampling points beneath the lakebed and from seepage meters on the lakebed. The tracer moved horizontally, curved gently upward, and entered the lake through an area of 17 sq m--an area 5.7 times larger than the initial cross-sectional area of the tracer zone. Seepage flux through the sediment-water interface declined exponentially with offshore distance and averaged 240 cu m/yr per meter of shoreline. Results showed that prediction of solute flux from onshore zones of groundwater contamination requires consideration of dispersion (mixing) and the ratio of horizontal to vertical permeability (K sub h:K sub v). Numerical simulations showed that with increasing K sub h:K sub v, tracer- or contaminant-entry areas on the lakebed extend over larger areas and are displaced farther offshore. A K sub h:K sub v of 10 matched the field observations. An analytical model indicated that the observed reduction in peak concentration (a decline to 31% of the initial value over a 6-m flow path) would result from values of longitudinal dispersivity as small as 1 cm. (Visocky-ISWS)
W80-04250

MODELLING AND ANALYSIS OF DATA FROM CATCHMENT STUDIES OF LAND USE CHANGE,
National Research Advisory Council of New Zealand, Wellington.
A. R. Rao, A. I. McKerchar, and A. J. Pearce.
Progress in Water Technology, Vol 11, No 6, p 579-597, 1979. 1 Fig, 40 Ref.

Descriptors: *Watersheds(Basins), *Water quality, *Runoff, *Land use, *Model studies, Mathematical models, Analytical techniques, Regression analysis, Stochastic processes, Hydrology, Hydrographs, Unit hydrographs, Urbanization, Conceptual models, Intervention analysis.

Catchment studies of effects of land use change on water quantity and quality have proliferated in recent years. Careful planning of these studies is necessary to ensure that questions of concern are posed as hypotheses and that the catchments instrumented will provide relevant data for testing the hypotheses. Appropriate analysis methods must be used to establish the significance of observed changes in quantity and quality characteristics. Regression methods have commonly been used but have limited applicability where the variance of the data may have been inhomogeneous. Alternative methods are unit hydrograph studies, conceptual modeling, and stochastic analysis. Unit hydrograph studies have been used to predict changes in storm runoff hydrographs as a result of increased urbanization of catchments. Conceptual models offer an alternative to the control catchment in traditional paired catchment experiments but have not assisted in predicting alterations in discharge resulting from land use change. Recently developed stochastic analysis methods are designed to identify, and to establish the significance of, interventions in stochastic processes. These methods have potential for application, although they are still being developed. (Sims-ISWS)
W80-04254

AGRICULTURAL LAND USE AND ITS EFFECT ON CATCHMENT OUTPUT OF SALT AND WATER--EVIDENCE FROM SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2F.
W80-04259

YIELD AND MACRONUTRIENT CONTENT OF WATER IN RELATION TO PLANT COVER FROM THE SNOW TUSSOCK GRASSLAND ZONE OF EASTERN AND CENTRAL OTAGO, NEW ZEALAND,
Otago Univ., Dunedin (New Zealand). Dept. of Biology.
A. F. Mark, and D. K. Holdsworth.
Progress in Water Technology, Vol 11, No 6, p 449-462, 1979. 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Water yield, *Nutrients, *Vegetation effects, Mountains, Grasses, Water balance, Rainfall, Precipitation(Atmospheric), Evaporation, Storage, Fog, Lysimeters, Water resources, Land use, *New Zealand.

A lysimeter approach to water yield within the high altitude snow tussock grassland zone of eastern and central Otago is demonstrating a significant difference in water yield associated with the type and condition of plant cover. From all but one of six sites within the zone of high altitude snow tussock (above about 750 m) the highest yields were associated with unmodified snow tussock grassland which returns 55-68% of the measured precipitation, substantially more than that yielded by a short turf of blue tussock grassland that frequently replaces mismanaged snow tussock in the region, or even from bare soil. Below this zone, in mixed fescue-snow tussock grassland that has been, or currently is being, converted into higher producing exotic pasture wherever topography permits, water yield under snow tussock from one site, associated with relatively low precipitation, was less than 50% of input and was exceeded by both a blue tussock sward and bare soil. Evidence was produced which indicates that substantial interception gains from fog by the tall fine foliage provided by a snow tussock canopy is the main factor accounting for the increased yield associated with this type of cover at higher altitudes within the region. This moisture source is not available to either a short grass turf or bare soil. Macronutrient levels of both rainfall and leachate associated with the snow tussock cover were presented but as yet are insufficient to compile nutrient budgets. Levels were generally in the range of those reported for natural ecosystems elsewhere. (Sims-ISWS)
W80-04260

THE CALIFORNIA WATER ATLAS.
California Office of Planning and Research, Sacramento.
1978. 124 p, 32 Plates, 4 Fig, 10 Tab, 108 Photo, 143 Ref.

Descriptors: *California, *Maps, *Water resources, *Urbanization, *Colorado River, *Central Valley Project, *Administration, *Water districts, *Water requirements, *Economics, *Industrial water, *Recreation, *Water quality, *Water management(Applied), *Water supply, *Water demand, *Conservation, Meteoric water, River systems, Water storage, Oceans, Flood control, Irrigation, Water rights, Boulder Canyon Project Act, Metropolitan Water Dist. of So. Cal., Federal-state water rights conflicts, Legal aspects, Water rights, Floods, Droughts, Recreational demand, Hydroelectric power, Navigation, Water quality control, Deltas, Demand, Supply, Technology, Water conservation, Data collections, *Sacramento Valley(CA), *Hetch Hetchy Valley(CA), Los Angeles water system.

The atlas was developed to provide the average citizen with a single-volume point of access to understanding how water works in California. It treats every aspect of water supply, delivery, and use in California--the nature of the water environment, the changes mankind has made in that environment, the history of water development, the operation of the major natural and artificial water systems of today, the relationship of water pricing to water consumption, the uses of water in industry, recreation, and energy development, the problems of water quality, and the current and emerging questions of water policy for the future. (Preece-ISWS)
W80-04444

2B. Precipitation

THE WEATHER REPORT PREDICTS RAIN--AN ESTIMATION OF WHERE, WHEN, AND HOW MUCH RAIN WILL FALL CAN NOW BE DETERMINED BY FREQUENCY ANALYSIS,
New Haven City, CT.
H. F. Goetz, Jr.
Water and Wastes Engineering, Vol 17, No 1, p 39-40, January 1980. 2 Fig, 1 Tab.

Descriptors: *Rainfall, *Design storm, *Frequency, Duration curves, Watersheds(Basins), Rainfall intensity, Precipitation intensity, Storms, Runoff, Drainage, Design, Curves, Frequency curves, Rating curves, Meteorology, Climatology, Time-intensity curves.

Consideration of the total rainfall amount and time period during which the rainfall occurred has resulted in the meteorological rating of storms. The Connecticut Bureau of Highways has compiled and issued a graph of the rainfall frequency curves for Connecticut which establishes relationships between total rainfall, duration of rainfall, and frequency of occurrence. Time-intensity patterns of storms have already been statistically investigated. Intensity-duration graphs, based upon frequency analysis by the method of extreme values, after Gumbel, have been plotted. This type of graph relates three variables--rainfall intensity, return period or frequency, and duration or time of concentration--for the watershed being investigated. These figures reveal that while the storm has only one return period in terms of meteorological data, this same storm results in a number of return periods of varying severity depending upon the time of concentration of the individual shed. Also, since intensity ranking of storms does not consider the areal pattern of the storm, it may not give the same results as obtained from a frequency-discharge curve for the shed. (Sims-ISWS)
W80-04211

ACID PRECIPITATION IN THE WESTERN UNITED STATES,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 2K.
W80-04213

EFFECTIVE RAINFALL ESTIMATION,
Technical Univ. of Prague (Czechoslovakia). Dept. of Irrigation and Drainage.
For primary bibliographic entry see Field 2G.
W80-04231

CONSTANT-RAINFALL INFILTRATION,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.

For primary bibliographic entry see Field 2G.
W80-04232

SPELLS OF DRY DAYS RELATED TO AGRICULTURAL DROUGHT IN INDIA,
Meteorological Office, Poona (India).
A. Chowdhury, S. S. Gokhale, and G. S. Rentala.
Mausam, Vol 30, No 4, p 501-510, October 1979. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Droughts, *Rainfall, *Semiarid climates, Dry seasons, Distribution patterns, Precipitation(Atmospheric), Agriculture, Data processing, Statistics, Analytical techniques, Climatology, Weather, Meteorology, *India.

Efficacy of dry spells in identifying drought-prone areas has been advanced in this study. For this purpose, daily rainfall from 1 June to 31 October, which nearly covers all growth phases of crops grown principally during kharif season for a 70-year period (1901-1970), for 26 stations in Maharashtra State, were analyzed. Two types of dry days were classified, namely, a day receiving less than 2.5 mm of rainfall and receiving less than 6.3 mm of rainfall. Dry spells for both categories were computed and analyzed. Similarly, probabilities of occurrence of dry spells of different lengths were analyzed. A theoretical distribution was also fitted to dry spells. The study revealed that logarithmic distribution nearly represents both categories of dry days. Analysis of dry spells and the probabilities confirmed that the hard-core of the drought in Maharashtra State is located over Ahmednagar district. Other areas which possess high degree of drought proneness are eastern parts of Pune, Satara, and Sangli districts and western parts of Sholapur, Aurangabad, and Bhir districts. In the coastal belt of Konkan and eastern parts of Vidarbha, the drought menace is comparatively less. (Sims-ISWS)
W80-04237

STUDY OF NORMAL RAINFALL OF SATARA DISTRICT,
Regional Meteorological Center, Bombay (India).
A. K. Mukherjee, B. Shyamala, and R. Mazumdar.
Mausam, Vol 30, No 4, p 493-500, October 1979. 6 Fig, 4 Tab, 3 Ref.

Descriptors: *Rainfall, *Distribution patterns, *Climatology, Forecasting, Weather forecasting, Precipitation(Atmospheric), Mountains, Elevation, Water resources, Semiarid climates, Statistics, Analytical techniques, Meteorology, Weather, *India, *Satara District(India).

Issue of districtwise Farmers' Weather Bulletin in its present form is too general to be of any specific use to the farmer. It was felt that attempts should be made to improve the Farmers' Weather Bulletins, and a beginning in this direction was made with a detailed study of rainfall characteristics over Madhya Maharashtra. It was often seen that there is wide variation in the intensity and distribution of rainfall even within the same district. A study of such rainfall characteristics of Satara district in south Madhya Maharashtra was undertaken. A rough line of delineation running north-south across the district was suggested which distinguishes the rainfall distribution in the talukas to the west and the talukas to the east. (Sims-ISWS)
W80-04238

ROLE OF TREE-RING ANALYSIS AND RELATED STUDIES IN PALAEO-CLIMATOLOGY: PRELIMINARY SURVEY AND SCOPE FOR INDIAN REGION,
Institute of Tropical Meteorology, Poona (India).
G. B. Pant.
Mausam, Vol 30, No 4, p 439-448, October 1979. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Dendrochronology, *Climatology, *Trees, *Tropical regions, Forests, Rainfall, Temperature, Semiarid climates, Data processing, Analytical techniques, *India, Dendroclimatology, Tree rings.

The subject of palaeoclimatology and various methods of palaeoclimatological research were introduced as a multidisciplinary approach. The methods of inferring climatological information from the tree-ring analysis and related studies along with relevant details of sample collection and limitations of the method were discussed. Current status of research in dendroclimatology was reviewed and important techniques were summarized. Available literature relating to growth-ring studies for Indian trees was surveyed, and important findings and limitations relevant to planning and establishment of dendroclimatic research in India were discussed. The scope and importance of dendroclimatic research in India in the light of existing information and a complex relationship of tropical climate with the tree-growth characteristics were presented. The trees of Pinus family such as Chir and other conifers along the Himalayan snowline and sub-Himalayan mountains with relatively prominent ring structure were believed to show a significant response to temperature and snowfall. Maintenance of favorable water balance throughout the year for the trees in the regions of scanty rainfall and occasional droughts is essential for their proper growth. Study of the interaction between various climatic factors during the growing season and possible effects of previous seasons on tree growth is essential for orchard owners and forest planners in these regions. Therefore, the urgent need for an intensive study of response of certain tree species in semiarid tropical regions of India to rainfall, in particular the instances of severe droughts, was recommended. The optimum water balance requirements of plant communities can be estimated on the basis of the statistical relationship between the growth parameters and the seasonal rainfall amounts. A comparison of growth parameters of trees from reserve forests and largely inhabited regions of similar climatic zones may bring out much demanded information about the role of forests on the ecological balance. (Sims-ISWS)
W80-04241

AN EFFECTIVE ANTIFREEZE FOR STORAGE RAINGAUGES,
Ministry of Works and Development, Christchurch (New Zealand), Water and Soil Div.
M. J. McSaveney.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 52-54, 1979.

Descriptors: *Antifreeze, *Rain gages, *Gages, Rain water, Rain, Alcohols, Hydrometers, Rainfall, Temperature, Water, *New Zealand, *Storage rain gages, Commercial antifreeze, Rain gage antifreeze, Methylated spirits, Water-antifreeze solution, Ice needles, Wood alcohol.

Commercial antifreeze will not protect a storage rain gage from freezing: it is too dense and does not mix with rainwater without stirring. The right density for an effective rain gage antifreeze is about 0.995 kg/l, so that the undiluted antifreeze floats between the evaporation-inhibiting oil layer and the water-antifreeze mixture. Such an antifreeze is self-stirring during rain. An antifreeze of this density was made by mixing almost equal quantities of commercial antifreeze and methylated spirits. A slight excess of the latter lighter alcohol was needed, and the correct density was best achieved when a hydrometer was used to test the mixture. The amount of mixture needed for adequate protection must be determined by experience. It varies between gage types and capacities, with rainfall and winter temperature, and even with the frequency of reading. (Roberts-ISWS)
W80-04243

STUDIES OF SILVER IODIDE ICE-FORMING ACTIVITY: VERIFICATION OF THEORY,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Chemical Kinetics and Combustion.
B. Z. Gorbunov, N. A. Kakutkina, and K. P. Koutzenogii.
Journal of Applied Meteorology, Vol 19, No 1, p 71-77, January 1980. 6 Fig, 26 Ref.

Descriptors: *Cloud seeding, *Silver iodide, *Particle size, *Model studies, Mathematical models, Temperature, Air temperature, Weather modification, Precipitation(Atmospheric), Rainfall, Fog, Freezing, Condensation, Crystals, Laboratory tests, Theoretical analysis, Aerosols, Meteorology, Cloud physics.

The dependence of the ice-forming activity on particle radius over the range 50 to 3000 A at fog temperatures of -5, -10, and -20C has been obtained. It was found by diffraction methods that silver iodide particles either have a hexagonal or a cubic low-temperature structure, depending on their size. With these data, the temperature dependences of the threshold particle radius were obtained for hexagonal and cubic modifications of silver iodide. These dependences were compared to theoretical ones obtained by Fletcher for various models of ice formation. It appears that neither the sublimation nor the freezing models describe the experiment. Taking into account the process of water condensation on silver iodide aerosol particles does not improve the situation. A comparison with the Fletcher theory of ice formation on particles with nonuniform surfaces was carried out. It was shown that there are no values of the theoretical parameters which will give a good fit to theory and experiment. (Sims-ISWS)
W80-04244

2C. Snow, Ice, and Frost

SYMPOSIUM ON GLACIER BEDS: THE ICE-ROCK INTERFACE.
Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, 1979. 445 p. Glen, J.W., Adie, R.J., Johnson, D.M., Homer, D.R., and MacQueen, A.D., editors. Published by the International Glaciological Society, Cambridge (England).

Descriptors: *Conferences, *Glaciology, *Ice, *Interfaces, *Beds, Reviews, Movement, Glaciers, Remote sensing, Erosion, Glaciohydrology, On-site investigations, Sediments, Physical properties, Melt water, Energy dissipation, Streams, Glaciation, Deformation, Melting, Temperature, Abrasion, Laboratory tests, Model studies, Boundary processes, Ice sheets, Ice-rock interfaces, Regelation.

The symposium objectives were to provide a review of the present (1977) state of knowledge of glacier beds and to report on recent and current work. The subject areas covered were: erosion and deposition processes, the nature of the ice-rock interface, the sliding boundary condition, physical and chemical properties of debris-laden basal ice, remote sensing, physical and chemical processes at the glacier bed, conditions at the base of Pleistocene ice sheets, and subglacial hydrology. (See W80-04314 thru W80-04339) (Humphreys-ISWS)
W80-04313

PROCESSES OF GLACIER EROSION ON DIFFERENT SUBSTRATA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
G. S. Boulton.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 15-38, 1979. 9 Fig, 42 Ref.

Descriptors: *Glaciation, *Beds, *Boundary processes, *Erosion, *Reviews, Sediments, Shape, Ice, Glaciers, Abrasion, Bedrock, Movement, Analysis, Analytical techniques, Velocity, Theoretical analysis, Model studies, On-site investigations, Interfaces, Rates, Erosion rates, Deformation, Basal ice, Substrata, Sliding, Drumlins, Flutes.

Most theories of glacier movement and subglacial erosion have assumed that glaciers rest on rigid bedrock surfaces. While this is probably correct for much of the bed area of most modern glaciers, deformable sediments do occur beneath them and formed a substantial area of the beds of large ice sheets during glacial periods. Observations and theories were presented and reviewed about the processes of glacier erosion of rock and unlithified

sediment beds both when they are frozen and unfrozen. Erosional bedrock landforms, such as roches moutonnees, indicate two principal subglacial erosional processes, plucking and abrasion. Where supraglacially derived debris is unimportant, plucking provides the tools which abrade the bed, and must be a quantitatively more important process than abrasion, though more localized. Where plucking is suppressed, erosion rates must be slow. Subglacial measurements of abrasion rates beneath a temperate glacier were used to test an earlier abrasional theory. The form of the predicted abrasion-rate curve for changing ice velocity and pressure was verified. This theory successfully simulates two-dimensional erosional bedforms. Subglacial observations demonstrate how flow of basal ice around the flanks of bedrock obstacles causes streaming of debris to occur. It was suggested that this streaming process is primarily responsible for the longitudinally lineated form of large-scale surfaces typical of glacially eroded bedrock. Plucking and abrasion also occur beneath cold ice, though at slow rates, and are probably restricted to places where the ice thickness is small. Where the glacier bed is composed of unlithified sediment, subglacial measurements show that deformation can produce very large discharges of subglacial material, which makes this a potential agent of very rapid subglacial landform production. The heterogeneity of subglacial sediment leads to spatially variable rates of deformation, and it was suggested that relatively stronger parts of the sediment body may form the nuclei for drumlin and mega-flute formation. Whereas unlithified unfrozen sediment deforms beneath the glacier rather than being incorporated within it, ice-cemented subglacial sediments can behave like bedrock, because of their relative rigidity, and are readily plucked and incorporated englacially. They may also deform beneath the glacier. (See also W80-04313) (Humphreys-ISWS)
W80-04314

A THEORETICAL MODEL OF GLACIAL ABRASION,
Stanford Univ., CA. Dept. of Geology.
B. Hallet.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 39-50, 1979. 6 Fig, 17 Ref. NSF EAR77-13631.

Descriptors: *Glaciation, *Abrasion, *Beds, *Model studies, *Boundary processes, Ice, Erosion, Theoretical analysis, Interfaces, Mathematical models, Analytical techniques, Movement, Glaciology, Glaciers, Loads(Forces), Deformation, Melting, Basal ice, Sliding.

Preliminary results of a quantitative model of glacial abrasion were presented. The analysis, which was constructed within a framework of modern glaciological views of processes near to the bed, was aimed at modeling abrasion under a temperate glacier whose basal layers contain only occasional rock fragments. It does not simulate abrasion by debris-rich ice or by subglacial drift. Calculations of abrasion-rates reduce to evaluations of the forces pressing rock fragments against the glacier bed and of the rates at which they are moved along the bed. The estimated viscous drag induced by ice flow toward the bed due to basal melting is generally the dominant contribution to this contact force. Several new results are noteworthy: (1) other parameters being equal, abrasion will tend to be fastest where basal melting is most rapid, (2) glacier thickness does not affect abrasion through its influence on basal pressures, and (3) lodgement of rock fragments is only possible if the sliding velocity is very low, equivalent to the rate of basal melting. (See also W80-04313) (Humphreys-ISWS)
W80-04315

SIMULATED GLACIAL ABRASION,
British Columbia Univ., Vancouver. Dept. of Geological Sciences.
W. H. Mathews.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 51-56, 1979. 2 Fig, 5 Ref.

Descriptors: *Glaciation, *Abrasion, *Laboratory tests, *Model studies, Laboratory equipment, Erosion, Beds, Instrumentation, Boundary processes, Methodology, Loads(Forces), Friction, Friction coefficient.

Glacial abrasion has been simulated by turning a grindstone made of ice and crushed quartz between two stone plates within a domestic deep-freeze. Within limits, the speed of rotation, the normal loading, and the temperature of operation can be controlled. The tangential force exerted on one of the stone plates can be measured. The ratio of tangential to normal force, the effective coefficient of friction, was found to vary with the 'roughness' of the grindstone, to increase gradually as abrasion proceeds, and to increase with decreasing velocity. Even at very low temperatures (to -26C), abrasion products accumulated in a pad of ice frozen to the tablet 'down-stream' from the grindstone, indicating that a water phase at least momentarily exists. The abraded surface of a fine-grained limestone displays grain-from-grain plucking dominating over abrasion of individual crystals. The abraded surface of a granite, by contrast, shows striations of crystals and rupture of cleavage along individual striae. (See also W80-04313) (Humphreys-ISWS)
W80-04316

THE SPECTRAL POWER DENSITY AND SHADOWING FUNCTION OF A GLACIAL MICRORELIEF AT THE DECIMETRE SCALE,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
J-P. Benoist.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 57-66, 1979. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Glaciation, *Beds, *Topography, Shape, Profiles, On-site investigations, Analytical techniques, Analysis, Shear, Bedrock, Statistical methods, Wavelengths, Measurement, Statistics, Spectral analysis, Spectral power density.

Longitudinal profiles of roches moutonnees were measured once every centimeter over a total length of more than 100 m. Only wavelengths in the range 3.6 cm less than lambda less than 40 cm were kept and analyzed. Levels and their slopes have a symmetrical, non-Gaussian distribution. The spectral power density varies roughly as gamma times nu to the -m power (nu = wavenumber = 1/lambda); n being the same for all the profiles (n = 2.36) and gamma being dependent on the studied area. No significant difference has been found for the shadowing function of the different studied areas. It seems that few parameters can quantitatively describe roches moutonnees; among these are the distribution of slopes and levels, the spectral power density, and the shadowing function. (See also W80-04313) (Humphreys-ISWS)
W80-04317

LOCAL FRICTION LAWS FOR GLACIERS: A CRITICAL REVIEW AND NEW OPENINGS,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
L. Lliboutry.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 67-95, 1979. 8 Fig, 2 Tab, 31 Ref.

Descriptors: *Glaciers, *Friction, *Reviews, *Model studies, *Boundary processes, Velocity, Glaciology, Movement, Mathematical models, Analytical techniques, Theoretical analysis, Bedrock, Beds, Ice, Rheology, Melting, Interfaces, Freezing, Heat balance, Mechanical properties, Viscosity, Drag, *Friction laws, Sliding.

'Sliding velocity' and 'friction law' were precisely defined. Different scales for tackling glacier dynamics were introduced. The energy balance in the melting-refreezing process was clarified. The validity of a Glen body as a model for ice rheology was discussed. The assumed model for subglacial water is a very slightly pervious ice, and a not absolutely watertight ice-bedrock interface, owing to glacial striae and rock joints. Then autonomous hydraulic regimes and cavities at water vapor pressure have a negligible influence on the drag, and only the interconnected regime has to be considered. A more rigorous treatment of Weertman's model (independent knobs) gives quite different numerical factors. In general a term increasing with Terzaghi's effective pressure N has to be added to the drag. The double-valued friction law found by Weertman was shown to have been an error. Kamb's relations for the model with a vanishing microrelief are considerably simplified. His conjectural solution cannot be extended to slopes actually found in the microrelief. The author's (Lliboutry, 1968) treatment was unsatisfactory and included an error. With a model consisting of irregular bumps of similar length, a new friction law was given. The pertinent measure of the bedrock roughness is then the shadowing function, not the spectral power density. (See also W72-02284 and W80-04313) (Humphreys-ISWS)
W80-04318

THE UNSOLVED GENERAL GLACIER SLIDING PROBLEM,
Northwestern Univ., Evanston, IL. Dept. of Materials Science and Engineering.
J. Weertman.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 97-115, 1979. 5 Fig, 73 Ref.

Descriptors: *Glaciology, *Boundary processes, *Reviews, *Theoretical analysis, Movement, Ice, Interfaces, Beds, Surfaces, Analytical techniques, Mathematical models, Erosion, Shape, Creep, Deformation, Rheology, Sliding, Basal ice, Roughness(Beds).

The status of the theory of glacier sliding was reviewed. The theory of Nye and Kamb essentially solves the problem of glacier sliding when the basal ice is in intimate contact with a nondeformable bed, but experimental work is needed on cyclic creep and the regelation process in order to put better numbers into the theory. The outstanding problem that remains to be solved, called in this paper the general glacier sliding problem, is the case of sliding when basal ice is not in intimate contact with a nondeformable bed because of the presence of cavities and a water film of finite thickness. This problem involves solving an intricately coupled basal water-flow problem. A new field of research is the study of the motion of glaciers over deformable beds. (See also W80-04313) (Humphreys-ISWS)
W80-04319

THE FLOW OF ICE, TREATED AS A NEWTONIAN VISCOUS LIQUID, AROUND A CYLINDRICAL OBSTACLE NEAR THE BED OF A GLACIER,
Institute of Hydrology, Wallingford (England).
E. M. Morris.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 117-129, 1979. 2 Fig, 21 Ref, 1 Append.

Descriptors: *Ice, *Flow around objects, *Boundary processes, *Mathematical studies, Glaciology, Viscous flow, Flow, Theoretical analysis, Movement, Equations, Analytical techniques, Fourier analysis, Regelation.

This paper described an analytical solution of the equations of motion and heat conduction for ice flowing around a cylindrical solid inclusion and over a solid plane boundary. This is intended to be a simplified representation of the flow of clean glacier ice around a stone and over a rigid rock bed. The ice is treated as a Newtonian viscous

liquid, and the equations are solved in two dimensions. Regelation boundary conditions are applied at both ice-rock interfaces. It was found that finite solutions for the temperature and stream function only exist for the special cases in which two dimensionless critical wavelengths are zero. That is, unless the stone is very far from the glacial bed, the classical regelation boundary conditions cannot be obeyed over the whole of its surface. (See also W80-04313) (Humphreys-ISWS)
W80-04320

A MATHEMATICAL APPROACH TO THE THEORY OF GLACIER SLIDING,
Trinity Coll., Dublin (Ireland). School of Mathematics.
A. C. Fowler.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 131-141, 1979. 2 Fig, 20 Ref.

Descriptors: *Ice, *Boundary processes, *Mathematical models, *Flow, Glaciology, Theoretical analysis, Analytical techniques, Interfaces, Movement, Viscous flow, Bedrock, Beds, Shape, Equations, Velocity, Mathematical studies, Model studies, Basal ice, Sliding.

Previous theories of glacier sliding are subject to the criticism that they are not properly formulated. This paper described how the basal ice flow may be related to the bulk ice flow by means of the formal mathematical method of matched asymptotic expansions. A complete model of the basal sliding (involving coupled problems in ice, water film, and bedrock) may be rationally reduced by a dimensional analysis to a consideration of the ice flow only, and regelation may be neglected provided roughness is absent on the finest scales (less than 1 mm). If the viscosity is supposed to be independent of the moisture content, then complementary variational principles exist that allow bounds on the drag to be obtained. In particular, these determine the magnitude of the basal velocity in terms of two crucial dimensionless parameters. Arguments were presented as to why realistic sliding laws should be taken as continuous functions of the temperature, and a (major) consequence of this assumption was mentioned. Finally, the effect of cavitation was discussed via an (exact) leading-order solution of the ice flow in the particular case of a Newtonian fluid and a 'small' bedrock slope. (See also W80-04313) (Humphreys-ISWS)
W80-04321

SIMULATED GLACIER SLIDING OVER AN OBSTACLE,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
R. Brepson.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 143-156, 1979. 14 Fig, 1 Tab, 13 Ref, 1 Append.

Descriptors: *Model studies, *Glaciers, *Movement, *Laboratory tests, Interfaces, Boundary processes, Ice, Viscometers, Laboratory equipment, Methodology, Glaciology, Drag, Analytical techniques, Petrology, Creep, Strain, Measurement, Shear, Beds, Sliding.

The sliding of temperate ice over two obstacles with sine-wave profiles (wavelength, 0.53 m; maximum slope, 0.22) and low thermal conductivity has been reproduced at full scale within a steel chamber. As expected, large cavities form between the ice and the obstacles so that the drag is limited. However, the delayed elasticity of bubbly ice modifies the expected behavior. At the base of the ice a fine-grained, bubble-free blue ice layer develops. The shear strain concentrates on the upstream side of bumps and in the blue ice layer. Tap-water ions enhance tertiary creep-rates. (See also W80-04313) (Humphreys-ISWS)
W80-04322

EMPIRICAL STUDIES OF ICE SLIDING,
Department of Science, Melbourne, Victoria (Australia). Antarctic Div.
W. F. Budd, P. L. Keage, and N. A. Blundy.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 157-170, 1979. 8 Fig, 2 Tab, 27 Ref.

Descriptors: *Ice, *Boundary processes, *Friction, *Laboratory tests, Interfaces, Glaciology, Methodology, Laboratory equipment, Analytical techniques, Analysis, Velocity, Erosion, Shear stress, Beds, Shape, Measurement, Movement, Rates, Sliding, Normal stress, Basal ice, Friction coefficient.

An experimental program was carried out for studying temperate-ice sliding over rock surfaces with a wide range of roughnesses, for normal and shear stresses comparable to those expected under real ice masses. The limiting static shear stress for acceleration was found to be directly proportional to the normal load giving a constant limiting coefficient of static friction characteristic of the surface. For a constant applied normal stress N and shear stress tau, well below the limiting static shear, a steady velocity V results which increases approximately proportionally to tau and decreases with increasing N and the roughness of the surface. For high normal stress the velocity becomes approximately proportional to the shear stress cubed and inversely proportional to the normal stress. As the shear stress increases, acceleration sets in, which for different roughness and normal loads, tends to occur for a constant value of the product tau times V. For some surfaces at high normal loads this acceleration was retarded by erosion. For constant-applied-velocity tests a steady shear stress resulted, which tended to become constant with high velocities, and which increased with increasing normal stress but with a reduced coefficient of sliding friction. The relevance of the results to the sliding of real ice masses was discussed with particular reference to the importance of the effect of the relative normal stress, above basal water pressure, to the sliding rate. It appears that the results presented can provide the basis for a sliding theory which has relevance to the sliding of ordinary glaciers and also to ice falls, surging glaciers, and fast-outlet polar glaciers. (See also W80-04313) (Humphreys-ISWS)
W80-04323

SEISMIC EVIDENCE FOR DISCRETE GLACIER MOTION AT THE ROCK-ICE INTERFACE,
Geological Survey, Menlo Park, CA.
C. S. Weaver, and S. D. Malone.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 171-184, 1979. 8 Fig, 14 Ref.

Descriptors: *Interfaces, *Seismic studies, *Glaciology, *Washington, Ice, Glaciers, Bedrock, Movement, On-site tests, On-site investigations, Avalanches, Seismic waves, Monitoring, Seasonal, Seismic properties, Travel time, Velocity, *Icequakes, Ice-rock interface, Sliding.

Seismic monitoring on three Cascade volcanoes in Washington State has shown that small seismic events are generated by the active glaciers found on each mountain. Detailed seismic experiments have been conducted to investigate the sources for these icequakes. Considerable evidence indicates that the events are the result of a stick-slip type of motion taking place at the bed of the glaciers. The few events the authors have been able to locate had depths comparable with the glaciers' thickness. The similarity of wave form from an explosion at the bottom of a glacier and natural icequakes suggests that the complexity of the seismic wave form is due to the path and not the source. The events exhibit an annual trend with more events being recorded in the summer than during the winter. A tenfold increase in the number of events preceded a large ice avalanche that involved the entire glacier thickness, suggesting that seismic monitoring may be useful in predicting catastrophic ice movements. (See also W80-04313) (Humphreys-ISWS)
W80-04324

ON THE ORIGIN OF STRATIFIED DEBRIS IN ICE CORES FROM THE BOTTOM OF THE ANTARCTIC ICE SHEET,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. J. Gow, S. Epstein, and W. Sheehy.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 185-192, 1979. 5 Fig, 11 Ref.

Descriptors: *Antarctic, *Interfaces, *Ice, *Cores, On-site investigations, Analysis, Sediments, Stratigraphy, Petrography, Particle size, Melting, Ice-rock interface, Ice sheets, Ice cores, Basal debris.

Cores from the bottom 4.83 m of the Antarctic ice sheet at Byrd Station contain abundant stratified debris ranging from silt-sized particles to cobbles. The nature and disposition of the debris, together with measurements of the physical properties of the inclosing ice, indicate that this zone of dirt-laden ice originated by 'freezing-in' at the base of the ice sheet. The transition from air-rich glacial ice to ice practically devoid of air coincided precisely with the first appearance of debris in the ice at 4.83 m above the bed. Stable-isotope studies made in conjunction with gas-content measurements also confirm the idea of incorporation of basal debris by freezing of melt water at the ice-rock interface. It is suggested that the absence of air from basal ice may well constitute the most diagnostic test for discriminating between debris incorporated in a melt-refreeze process and debris entrapped by purely mechanical means, e.g., shearing. It was concluded from observations on bottom cores from Byrd Station that 'freezing-in' of basal debris is the major mechanism by which sediment is incorporated into polar ice sheets. (See also W80-04313) (Humphreys-ISWS)
W80-04325

THE DEBRIS-LADEN ICE AT THE BOTTOM OF THE GREENLAND ICE SHEET,
State Univ. of New York at Buffalo, Amherst. Ice Core Lab.
S. Herron, and C. C. Langway, Jr.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 193-207, 1979. 5 Fig, 2 Tab, 51 Ref.

Descriptors: *Ice, *Interfaces, *On-site investigations, Stratigraphy, Carbon dioxide, Analysis, Particle size, Shape, Gases, X-ray analysis, Quartz, Kaolinite, Crystals, Argon, *Ice cores, *Greenland, Ice sheets, Debris, Basal ice, Ice texture.

The Camp Century, Greenland, ice core was recovered from a bore hole which extended 1375 m from the surface of the Greenland ice sheet to the ice/subice interface. The bottom 15.7 m of the core contain over 300 alternating bands of clear and debris-laden ice. The size of the included debris ranges from particles less than 2 micrometers in diameter to particle aggregates which are a maximum of 3 cm in diameter: the average debris concentration is 0.24% by weight. The debris size, concentration, and composition indicate that the debris originates from the till-like material directly below the debris-laden ice. The total gas concentration averages 51 ml/kg ice compared to the average of 101 ml/kg ice for the top 1340 m. The gas composition of debris-bearing ice has apparently been modified by the oxidation of methane as reflected by traces of methane, high CO2 levels, and low O2 levels with respect to atmospheric air. Argon, which is not affected by the oxidation, shows an enrichment in samples with lower gas concentrations. Both the low gas concentration in the debris-laden zone and the argon enrichment may be explained by the downward diffusion of gases from bubbly glacier ice into an originally bubble-free zone of refrozen debris-laden ice. Ice texture and ice-fabric analyses reveal extremely

fine-grained ice and highly preferred crystal orientation in the lowermost 10 m of the core, indicating a zone of high deformation. (See also W80-04313) (Humphreys-ISWS)
W80-04326

DISCONTINUOUS FLOW, ICE TEXTURE, AND DIRT CONTENT IN THE BASAL LAYERS OF THE DEVON ISLAND ICE CAP,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
R. M. Koerner, and D. A. Fisher.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 209-222, 1979. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Ice, *Soils, *Beds, Analysis, Crystals, Bedrock, Flow, Stratigraphy, Particle size, Oxygen isotopes, *Ice cores, *Devon Island, Basal ice, Ice texture, Ice cap.

Surface-to-bedrock cores obtained with a CRREL thermal drill were taken in 1972 and 1973 from the top of the Devon Island ice cap. There are very pronounced variations in oxygen isotope, microparticle concentration, and ice texture in the lower-most 5 m of the core. There is a section of isotopically cold, very fine bubbly ice with high microparticle concentrations between 2.6 and 4.4 m above the bed, considered to represent the Last Ice Age. There is coarse, isotopically warm, clean ice above and below this. For 1.2 m above the bed, the ice is finer again with high microparticle concentrations, but it shows very low bubble concentration and is isotopically the warmest in the core. While the broad variations are common to both cores, in detail there are significant variations despite the fact that the cores were taken only 27 m apart. The variations, when analyzed statistically, show that at least 25-30% of the originally continuous profile is missing from each core. Faulting within the near-bedrock ice may be responsible for some of the effect, but bubble fabric also gives evidence for irregular nonlaminar flow. Because of the strong relationship between crystal size and microparticle concentrations in the Devon Island cores, it is suggested that the fine-grained nature of dirty layers in the Antarctic and Greenland ice sheets is due to the effect of the dirt inclusions and not of shearing. Steep isotopic gradients in the Devon Island cores are shown to be evidence for possible shearing, which does not effect any change in the crystal texture. Clear ice near the bed is considered a tectonic feature, but the lack of effect on its bed by the ice cap confirms the nonerosional nature of an ice cap frozen to its bed. In terms of paleoclimatic history, it means that, because of bedrock effects, ice caps of intermediate depth (i.e., less than 400 m) can give continuous information only over the last approximate 5000 years. Between 5000 and 10,000 B.P., the time series becomes slightly discontinuous and beyond 10,000 B.P. so discontinuous as to allow only broad climatic inferences to be drawn. (See also W80-04313) (Humphreys-ISWS)
W80-04327

DEPOLARIZATION OF RADIO WAVES CAN DISTINGUISH BETWEEN FLOATING AND GROUNDED ICE SHEETS,
Natural Environment Research Council, Cambridge (England). British Antarctic Survey.
A. H. W. Woodruff, and C. S. M. Doake.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 223-232, 1979. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Ice, *On-site investigations, *Remote sensing, *Antarctic, Radio waves, Sounding, Analytical techniques, Analysis, Electromagnetic waves, Anisotropy, Beds, Surveys, Methodology, On-site tests, Movement, Floating, Ice sheets, Grounded ice, Ice shelf, Echo sounding, Ice thickness.

Polar ice is now thought to be marginally birefringent at radio echo-sounding frequencies. An experiment on the polarization behavior of 60 MHz radio echoes from the bed of both ice shelf and land ice in Antarctica showed a marked difference in the returned polarization. It appears that differences in electrical properties or roughness of the reflecting boundary cannot explain the results. It is suggested that there is a large change in the birefringence of the ice sheet at the hinge zone, caused by the effect of tidal strain on crystal orientation. This would imply a minimum value of the radio-frequency anisotropy in permittivity for the single crystal of (0.52 + or - 0.8)%; therefore, polarization changes could allow floating and grounded ice to be distinguished. (See also W80-04313) (Humphreys-ISWS)
W80-04328

ENERGY DISSIPATION DURING SUBGLACIAL ABRASION AT NISQUALLY GLACIER, WASHINGTON, U.S.A.,
Washington Univ., Seattle. Geophysics Program.
R. C. Metcalf.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 233-246, 1979. 3 Fig, 3 Tab, 35 Ref.

Descriptors: *Glaciers, *Abrasion, *Energy, *Washington, On-site investigations, Sediments, Glacial sediments, Melt water, Ice, Scour, Erosion, Rocks, Model studies, Mathematical models, Glaciology, *Nisqually Glacier(WA).

This study examined the effect of subglacial abrasion on the basal sliding term of the gravitational energy balance of the dynamic, temperate Nisqually Glacier on Mount Rainier, Washington. Subglacial water flux was estimated as 3 x 10 to the 7th power cu m/yr and suspended sediment flux as 3 x 10 to the 7th power kg/yr. Suspended-sediment flux was assumed to represent, within an order of magnitude, the annual mass eroded by subglacial abrasion. Subglacial abrasion involves both brittle fracture and plastic deformation. Field observations of bas-relief and grooved depression striations appear to have exact counterparts in rock mechanics experiments approximating subglacial velocities and normal stresses. Boulton's abrasion model and a new attritivity model proposed herein were shown to predict subglacial abrasion-rates within the limits of natural variability and the error range of measurements. The first crude gravitational energy balance for lower Nisqually Glacier (1.96 sq km) was attempted and probably has only order-of-magnitude accuracy. The importance of subglacial abrasion in dissipating basal sliding energy at Nisqually Glacier was confirmed. (See also W80-04313) (Sims-ISWS)
W80-04329

SEDIMENT CONCENTRATION IN MELT WATERS AS AN INDICATOR OF EROSION PROCESSES BENEATH AN ALPINE GLACIER,
Manchester Univ. (England). Dept. of Geography.
D. N. Collins.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 247-257, 1979. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Sediments, *Melt water, *Glaciers, Sampling, On-site investigations, Suspended solids, Discharge(Water), Ablation, Variability, Sediment transport, Erosion, Data processing, Sedimentology, Glaciology, *Gornera Glacier(Switzerland).

Suspended-sediment concentrations in melt waters from the Gornera, Gornergletscher, Switzerland, were determined at hourly intervals for periods during the ablation seasons of 1974 and 1975. Rapid erratic fluctuations of suspended-sediment concentration produced peaks which occurred both before and after highest daily flows. Clockwise daily hysteresis rating loops between sediment concentration and discharge included many involutions. Suspended-sediment concentration-discharge rating curves were different for rising and falling limbs of individual diurnal hydrographs and varied from day to day. Close-interval measurements of sediment concentration and discharge records allow interpretation of the nature of ice-water-sediment interactions at the bed of an Alpine glacier. At Gornergletscher, subglacial sediment is delivered to melt waters flowing in the smaller basal conduits, which often change course suddenly, entraining unworked sediment stored at the bed. During diurnal discharge maxima, sediment concentration in the Gornera is reduced because the rate of increase of water volume outstrips the rate of supply of sediment. The drainage of the ice-dammed lake Gornersee, producing exceptionally high flows, extended the drainage network over large areas of the glacier bed, and evacuated much sediment. (See also W80-04313) (Sims-ISWS)
W80-04330

PRESSURE-MELTING EFFECTS IN BASAL ICE OF TEMPERATE GLACIERS: LABORATORY STUDIES AND FIELD OBSERVATIONS UNDER GLACIER D'ARGENTIERE,
Cambridge Univ. (England). Cavendish Lab.
D. J. Goodman, G. C. P. King, D. H. M. Millar, and G. de Q. Robin.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 259-271, 1979. 7 Fig, 13 Ref, 1 Append.

Descriptors: *Ice, *Glaciers, *Pressure, *Melting, Laboratory tests, On-site investigations, Strain gages, Bedrock, Heat flow, Temperature, Freezing, Glaciology, *Glacier d'Argentiere(France), Regelation.

The suggestion that patches of basal ice may freeze to the bed of a glacier due to certain regelation effects has been tested in the laboratory by applying high hydrostatic pressures to ice samples at the pressure-melting point. During compression, ice temperatures follow the pressure-melting point closely, but after rapid decompression the ice temperature at first returns only half to three-quarters of the way to the pressure-melting point, after which it appears to warm by thermal conduction from outside the ice sample. If the moving ice at the base of a glacier behaves in the same way as it is exposed to changing pressure fields, frozen patches at bedrock are to be expected. Records of strain variations in a tunnel beneath Glacier d'Argentiere show two types of strain events. The first is a rapid jump or offset in the recorded strain, while the second are strain excursions, initiated by a change in strain over a period up to ten seconds, followed by a gradual recovery to the original strain over some minutes. It was suggested that the offset events are due to nearby stress release due to fracturing of frozen patches of ice at the bedrock, while the strain-excursion events show the more distant adjustment of the glacial bed to the former events due to the time lags associated with changes of water-film thickness and regelation heat flow. (See also W80-04313) (Sims-ISWS)
W80-04331

OBSERVATIONS WITHIN CAVITIES AT THE BED OF THE GLACIER OSTERDALSISEN, NORWAY,
Manchester Univ. (England). Dept. of Geography.
W. H. Theakstone.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 273-281, 1979. 4 Fig, 28 Ref.

Descriptors: *Glaciers, *Ice, *Movement, Deformation, Plastic deformation, Temperature, Strain, Bedrock, Rocks, Glaciology, *Glacier Osterdalsisen(Norway), Subglacial cavities, Regelation, Basal ice.

Basal ice at the glacier Osterdalsisen commonly deforms under stress within cavities at the glacier bed. Some ice subject to rapid strain, however, fails in a brittle manner. The creep-rate of basal ice is influenced by sediment particles within it, and by ice grain-size and structural anisotropy; a flow law for such ice has not been derived experimentally.

Near the glacier bed, particles enclosed in ice may migrate as a result of stress concentration, bubbles may be flattened, and anisotropic structures may develop. Recrystallization leads to grain-size changes. Both regelation spicules and layers of regelation ice, generally thin, form within subglacial cavities, but their occurrence is limited. Regelation-ice formation has a significant influence on the distribution of rock debris at the ceilings of subglacial cavities. (See also W80-04313) (Sims-ISWS)
W80-04332

A SEQUENCE OF GLACIAL DEFORMATION, EROSION, AND DEPOSITION AT THE ICE-ROCK INTERFACE DURING THE LAST GLACIATION: CRANBROOK, BRITISH COLUMBIA, CANADA,
University of Western Ontario, London. Dept. of Geology.
B. E. Broster, A. Dreimanis, and J. C. White.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 283-295, 1979. 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Bedrock, *Glaciation, *Geomorphology, *Canada, Deformation, Plastic deformation, Erosion, Deposition(Sediments), Rocks, Till, On-site investigations, Geology, Ice, Fractures(Geologic), Glaciers, Glaciology, *British Columbia.

A comparison of bedrock fractures with orientation of structures and fabric in the overlying late Pleistocene basal till indicated a sequence of common glacial origin. The deformations in bedrock and till, and the deposition of the till layer, were accomplished by two glacial flows that were part of a mountain ice sheet: the regional (moving south-south-east) and the local (moving south-south-west) along Peavine Valley. The following sequence of events was postulated from this investigation: the initial glacial advance from the north-north-west that produced conjugate low-angle shear fractures in the bedrock was followed by competition of both the regional and the Peavine Valley glacial flows which also produced low-angle fracture systems. As the over-riding ice became thicker, high-angle conjugate fractures were formed by both glacial flows. Subsequently, south-east-dripping injection wedges were formed by the regional ice, which was concurrently eroding the down-glacier parts of the wedged blocks, depositing local till, and producing sigmoidal deformations in this till. The main deposition of the overlying lodgement till was accomplished by an interaction of both the regional and the Peavine Valley glacial flows, and the lodgement was supplemented by shearing of the till, producing fissility. Bedrock wedging, as a significant process of glacial erosion, is believed to be discussed here for the first time. (See also W80-04313) (Sims-ISWS)
W80-04333

GIANT GROOVES MADE BY CONCENTRATED BASAL ICE STREAMS,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
R. P. Goldthwait.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 297-307, 1979. 6 Fig, 21 Ref.

Descriptors: *Glaciation, *Erosion, *On-site investigation, *Ohio, Bedrock, Ice, Streams, Beds, Abrasion, Analysis, Surveys, Land forming, Geomorphology, *Kelleys Island(OH), Basal ice, Ice sheets, Glacial grooves, Flutes.

Glacial grooves are known on all the flat-lying limestone islands in western Lake Erie. The largest megagroove complexes are on Kelleys Island, each 2-6 m deep, 5-20 m wide, and 100-400 m long before quarrying. Each megagroove floor is rolling with second-order rounded ridges and 'sine-shaped' grooves 10-90 cm deep and 5-40 m long. Furthermore, these are gouged laterally by sharply curving and nesting gouges up to 10 cm deep. All grooves exhibit third-order striation up to 1-2 mm deep and 5-200 cm long made by individual tools of debris traveling mostly 240-260 degrees. Ice of the Erie lobe was under compressive flow as it rose from 9 m below present lake level to 12 m above. Some sort of ice vortices (fixed eddies in the basal ice stream) are postulated to make the scoop marks and ridge ends. Fast-moving ice rather than water or a slurry is favored because there are no percussion marks. Very likely, a till mat of interfering engraving points is required. A strong convergence (2x to 10x) of striae into the deepest grooves indicates squeezing together of the debris tools and increase in local ice velocity. Interglacial subareal streams may well have shaped the initial trough up which these ice streams concentrated, because dendritic tributary grooves intersect, and main groove sets curve as much as 10 degrees or 20 degrees. Furthermore, sharp 100-180 degrees meander curves are preserved at the bottom of the deepest grooves. Hiram-age clay-till with rare erratics half fills the original grooves; it shows that this groove cutting was completed before 15,500 14C years ago. (See also W80-04313) (Humphreys-ISWS)
W80-04334

DIRECT MEASUREMENT OF BASAL WATER PRESSURES: PROGRESS AND PROBLEMS,
Geological Survey, Tacoma, WA. Water Resources Div.
S. M. Hodge.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 309-319, 1979. 2 Fig, 12 Ref.

Descriptors: *Glaciers, *Boreholes, *Water pressure, On-site investigations, Measurement, Drilling, Drill holes, Pressure, Water levels, Glaciology, *South Cascade Glacier(WA), *Blue Glacier(WA), Basal water, Subglacial water.

In 1975 and 1977, 24 bore holes were drilled to the bed of South Cascade Glacier, Washington, using both electrothermal and hot-water drills. Only two holes connected directly with the basal water system, a significant decrease from the four to five such connections in 13 holes drilled in 1973 and 1974. Most of the bed, possibly as much as 90%, appears to be hydraulically inactive and isolated from a few active subglacial conduits. Bore holes which penetrate these inactive areas initially should connect eventually with the active basal water system due to bed pressurization by the water standing in the bore hole, provided there is a sufficient supply of water available to form and maintain the connection passageway. These sealed-off areas probably consist of the subsole drift and permeability barriers found recently at the bed of Blue Glacier; an increase in the area of bed covered by these features probably caused the decrease in chance of bore-hole connection. This apparently was not due to any external cause but rather was the result of a real internal change in the subglacial hydraulic system which occurred between 1974 and 1975. If most of the area of a glacier bed is hydraulically isolated subsole drift, or something similar, such features may well control large-scale glacier sliding changes, since changes in the amount of water having access to the glacier bed will take considerable time to affect the interstitial water pressure in the more widespread subsole drift. Water pressures in the active part of the basal water system of South Cascade Glacier are generally in the range of 50-75% of the ice overburden pressure. Water levels in a connected bore hole are probably representative over an area of the bed 100 m or more in extent. A correlation of bore-hole water levels with changes in surface motion supports the idea that the sliding of a temperate glacier is controlled largely by the basal water pressure. (See also W80-04313) (Sims-ISWS)
W80-04335

SUBGLACIAL REGELATION WATER FILM,
Stanford Univ., CA. Dept. of Geology.
B. Hallet.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 321-334, 1979. 5 Fig, 41 Ref. NSF EAR77-13631.

Descriptors: *Glaciers, *Chemical precipitation, *Carbonates, *Calcite, Bedrock, Films, Chemical analysis, Geomorphology, Variability, Temporal distribution, Spatial distribution, Glaciology, Regelation, Basal water.

Recent studies of subglacially precipitated carbonate deposits and associated solutional furrows have provided interesting new insight on subglacial water films, as well as on chemical exchange at the glacier bed. Considerable information on the film thickness and its temporal and spatial variability has been gained by analyzing several properties of subglacial carbonate deposits including: (1) the morphology of surface features aligned parallel to ice flow, (2) the laminated structure, and (3) the size distribution of fine rock fragments presumably transported in the film prior to their incorporation in the deposits. Chemical analyses of water from pro-glacial streams, together with calculations of CaCO3 solubility and mass balance, showed that the channelized water is chemically distinct from the film water in which CaCO3 precipitates, and that subglacial precipitation is not possible where there is a considerable water flux through the film in excess of that associated with regelation sliding. The principal implication of these studies was that a temperate cirque glacier is characteristically separated from its bed by a thin water film, probably micrometers in thickness; however, the film appears to occasionally thicken, at least locally by as much as a hundredfold in exceptional cases. Furthermore, the water flux and/or solute concentration in the basal film undergoes periodic, probably seasonal, variations possibly related to variations in the amount of water reaching and flowing through the basal film. (See also W80-04313) (Sims-ISWS)
W80-04336

GEOMETRY OF FORMER SUBGLACIAL WATER CHANNELS AND CAVITIES,
Stanford Univ., CA. Dept. of Geology.
J. Walder, and B. Hallet.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 335-346, 1979. 8 Fig, 31 Ref. NSF EAR77-13631.

Descriptors: *Glaciers, *Bedrock, *Abrasion, *Erosion, Flow, Rocks, Chemical precipitation, Mapping, Geology, Scour, Glaciology, Basal ice, Basal water, Cavities.

The spatial pattern of the formerly active processes of water flow, cavitation, abrasion, dissolution, and precipitation at the base of a small cirque glacier has been reconstructed by detailed mapping of surficial features on recently deglaciated limestone bedrock near the glacier terminus. Interpretation of these features, which reflect basal conditions averaged over a period of several or several tens of years, leads to the following conclusions: (1) A nearly continuous, nonarborescent network of cavities and incised channels existed and probably acted as the primary drainage of melt waters. This network evolved through time as many channels were filled, perhaps intermittently, by basal ice. (2) At least 20% of the glacier sole was separated from the bed by water-filled cavities. The rest of the glacier-rock interface characteristically comprises a very thin water film. (3) Abrasion was locally intensified, relative to chemical alteration, in 5-10 m wide zones paralleling the ice-flow direction, perhaps as a result of locally enhanced sheet flow of subglacial water. (See also W80-04313) (Sims-ISWS)
W80-04337

QUANTITATIVE DETERMINATION OF THE SUBGLACIAL HYDROLOGY OF TWO ALPINE GLACIERS,
Manchester Univ. (England). Dept. of Geography.
D. N. Collins.
In: Symposium on Glacier Beds: The Ice-Rock

Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 347-362, 1979. 5 Fig, 2 Tab, 30 Ref.

Descriptors: *Glaciers, *Hydrology, *Flow, *Discharge(Water), Melt water, Water chemistry, On-site investigations, Model studies, Mathematical models, Sediments, Electrical conductance, Hydrographs, Glaciology, Subglacial hydrology, Flow components.

Two components of discharge through the internal hydrological systems of Alpine glaciers were separated on the basis of chemical composition of water. Some surface melt waters retain low solute contents after flowing without delay through conduits in which no chemical enrichment occurs, whereas those flowing slowly at the glacier bed have increased ionic concentrations. A simple mixing model was used to investigate temporal variations in the quantities of water routed through each of the two subsystems. Electrical conductivity was taken as an indicator of melt-water composition and was monitored for periods during the summer ablation season of 1975 at Gornergletscher and of 1977 at Findelengletscher. At both glaciers, conductivity of melt waters varied diurnally inversely with discharge fluctuations, depending on the proportion of total discharge routed through the two subsystems. Total discharge and the flow component routed rapidly through conduits within the glacier, a large proportion (50-80%) of total discharge, exhibited in-phase rhythmic diurnal hydrographs at the two glaciers. Distinctive subglacial hydrological regimes were contrasted. At Findelengletscher, the hydrographs of total discharge and of subglacial chemically enriched flow were in phase. At Gornergletscher, the subglacial hydrograph occurred with reverse asymmetry and out of phase. A possible interpretation is that water was temporarily stored in basal cavities during high total discharge. During the night, stored water was released, contributing much of the total discharge at times of low flow. (See also W80-04313) (Sims-ISWS)
W80-04338

SUBGLACIAL CONSTRUCTIONS AND INVESTIGATIONS AT BONDHUSBREEN, NORWAY,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
B. Wold, and G. Ostrem.
In: Symposium on Glacier Beds: The Ice-Rock Interface, Proceedings of a Symposium held at Carleton University, Ottawa (Ontario), August 15-19, 1978. Journal of Glaciology, Vol 23, No 89, p 363-379, 1979. 12 Fig, 2 Tab, 8 Ref.

Descriptors: *Glaciers, *Drainage, *Construction, *Tunnel construction, Ice, Bedrock, Rocks, Till, Tunnels, Tunneling, Flow, Discharge(Water), Hydrology, Glaciology, Subglacial water, Subglacial water intakes, Basal ice, Basal water.

For the construction of a hydroelectric power station in western Norway, a diversion tunnel was made to collect subglacial melt water under an outlet glacier from the Folgefonni ice cap. Many investigations were carried out by glaciologists and engineers before the project could begin, and several unexpected problems arose during the completion of the project. This paper dealt with some of the problems and how they were solved. To avoid coarse glacier-carried material from being flushed into the water-collecting tunnel system, a large sedimentation chamber was constructed in the bedrock under the glacier. The dimensions of this huge chamber were decided from sediment-transport studies in the glacier stream and from studies of old bottom deposits in a lake close to the glacier front. Ice-velocity measurements were made on the glacier surface, and similar studies were attempted in subglacial ice caves made by spraying hot water near the glacier bed, where the ice is 170 m thick. The subglacial water-drainage system was studied from a horizontal tunnel constructed in the bedrock under the glacier. Some preliminary conclusions were drawn from these studies. In future, it will still be possible to undertake subglacial studies because inspection tunnels have been left in the bedrock, and the accessibility is relatively good. (See also W80-04313) (Sims-ISWS)
W80-04339

2D. Evaporation and Transpiration

ESTIMATES OF LAKE ST. CLAIR EVAPORATION,
National Oceanic and Atmospheric Administration, Ann Arbor. MI. Great Lakes Environmental Research Lab.
J. A. Derecki.
Journal of Great Lakes Research, Vol 5, No 2, p 216-220, 1979. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Evaporation, *Lakes, *Mass transfer, *Estimating, Equations, Temperature, Air temperature, Winds, Humidity, Ice cover, Estimating equations, Water temperature, *Lake St. Clair.

Monthly evaporation from Lake St. Clair was determined for individual years of a 26-year period, 1950-75, by the mass transfer method applied to available land-based data adjusted to overwater conditions. Because of extensive ice cover on the lake, the overwater mass transfer results were adjusted for the effect of ice cover during winter. The ice-cover adjustment reduced the average annual evaporation by 100 mm to 750 mm. The mass transfer method is the only technique that permits operational evaporation estimates from this lake with presently available data, and it is also the approach most amenable to future improvements. (Sims-ISWS)
W80-04217

ASSESSMENT OF THE QUALITY OF GENERALIZED WIND FUNCTIONS IN PENMAN'S EQUATIONS,
Dar es Salaam (Tanzania). Dept. of Physics.
C. J. Stigter.
Journal of Hydrology, Vol 45, No 3/4, p 321-331, February 1980. 2 Tab, 29 Ref.

Descriptors: *Winds, *Equations, *Mass transfer, Evaporation, Atmosphere, Water management(Applied), Agriculture, Management, Meteorological data, *Wind functions, *Penman's equations, Bulk mass transfer, Evaporating surface, Potential evaporation, Crop evaporation, Atmospheric instability, Water management problems.

A simplification of the aerodynamical expression for bulk mass transfer over a rough evaporating surface was used to assess the quality of generalized empirical statistical wind functions in Penman's equations. It was shown that Penman's revised wind function for the open water case was good enough to be preferred over any attempt for more adaptations. It was also shown that for the case of potential evaporation, or reference crop evaporation, a recent approach by Doorenbos and Pruitt formed an appreciable improvement. Comparison with another generalization by Thom and Oliver showed that the generalized wind functions preferred held also under conditions of atmospheric instability. Limitations were discussed for using reference crop evaporation formulas with only a generalized wind function in agricultural water management problems. (See also W77-09953) (Roberts-ISWS)
W80-04230

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, II. EVAPORATION FROM ATRIPLEX PLANTATIONS OVER A SHALLOW SALINE WATER TABLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
E. A. N. Greenwood, and J. D. Beresford.
Journal of Hydrology, Vol 45, No 3/4, p 313-319, February 1980. 5 Fig, 4 Ref.

Descriptors: *Evaporation, *Vegetation, *Landscaping, Salinity, Soils, Plant populations, Groundwater, Water table, Transpiration, Shrubs, *Landscapes, *Secondary salinity, Ventilated-chamber technique, Ungrazed plantations, Bare soils, Groundwater levels, Plots, Nocturnal transpiration.

Daytime evaporation from ungrazed plantations of Attriplex vesicaria, of varying spacing between bushes, was determined during summer. Daily evaporation from individual bushes, plus 1 sq m of surrounding soil, declined significantly with increasing closeness of planting (3.3-1.3 mm/d). Evaporation from bare soil between plants was not affected by spacing and averaged 0.4 mm/d. The integration of these two sources of evaporation showed that total evaporation significantly increased with closeness of spacing from 0.7 to 1.3 mm/d. The increase in evaporation was reflected in groundwater levels measured at the center of each plot throughout the summer. The water table under plots with the closest spacing was 10-20 cm deeper (P less than 0.05) than under the widest spacing. This suggested that Atriplex may have a hydrologic role in saltland reclamation in addition to its value as a grazing plant. There was evidence of a low rate of nocturnal transpiration. (Roberts-ISWS)
W80-04273

SUITABILITY OF REGION-WIDE IRRIGATION SCHEDULING BY LOCAL EVAPOTRANSPIRATION MEASUREMENT,
Nebraska Univ. Panhandle Station at Scottsbluff.
W. L. Trimmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169360, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Nebraska, Project Completion Report, March 1980. OWRT A-050-NEB (1), 14-34-0001-9029.

Descriptors: *Irrigation scheduling, *Evapotranspiration, *Irrigation design, *Irrigation efficiency, Model studies, Analytical techniques, Instrumentation, Climatology.

Irrigation scheduling requires an estimate of evapotranspiration (ET) to provide a means of determining when to irrigate and with how much water. Measuring ET or crop water use at every site is too expensive. Three sites in the Nebraska Panhandle were chosen as measurement sites. The three formed a triangle approximately 95 km on a side and represented three distinct different climates. Three years ET data for June through August showed relatively little difference between the sites. Norman instrument error explained a great deal of the variation. Instrument calibration, including hygrothermographs and silicon cell pyranometers, proved difficult and illustrated that the fewest number of measurement sites was optimum. Poor calibration can account for far greater differences than climatological differences within a 100-km radius given no great orographic, elevation or micrometeorological differences in location.
W80-04442

2E. Streamflow and Runoff

RUNOFF CURVE NUMBERS FROM PARTIAL AREA WATERSHEDS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
R. H. Hawkins.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15024, p 375-389, December 1979. 10 Fig, 2 Tab, 14 Ref, 2 Append.

Descriptors: *Runoff coefficient, *Storms, *Surface runoff, *Watersheds(Basins), Methodology, Hydrology, Hydrologic data, Analytical techniques, Infiltration rates, Antecedent moisture content, *Runoff curve numbers, *Potential site retention, Small watersheds, Initial abstraction.

Runoff curve numbers are coefficients used in a technique for estimating surface runoff from rainstorms. Analyses of rainfall-runoff events for small watersheds (60 to 4200 acres) in Arizona, Colorado, Utah, and Wyoming show that the curve number decreases with increase in storm rainfall, approximating the runoff as a simple fraction of the

rainfall. This strongly suggests a constant 'impervious' runoff-source area, like channel interception, accompanied by high infiltration rates relative to storm intensity and a constant role for antecedent moisture (uniformly dry). However, extremes in storm intensity or watershed wetness may invoke other processes. (Singh-ISWS)
W80-04207

APPROXIMATE FLOOD ROUTING METHODS: A REVIEW,
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
P. E. Weinmann, and E. M. Laurenson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15057, p 1521-1536, December 1979. 5 Fig, 1 Tab, 16 Ref, 2 Append.

Descriptors: *Flood routing, *Model studies, *Open channel flow, *Unsteady flow, Hydraulics, Hydrology, Analytical techniques, Numerical analysis, Rating curves, Hydraulic models, *Finite difference method, *Kinematic wave models, Dynamic effects.

Some well-known approximate flood routing models, including diffusion analogy models, kinematic wave models, and various extensions of the storage routing methods, were reviewed in the light of their theoretical background. A class of kinematic models was identified, and close relationships among many superficially diverse models were demonstrated. Limits of application for different groups of models were indicated, and some emphasis was placed on the analyses of parameter selection procedures. Attention was drawn to the kinematic model corrected for dynamic effects, a generalized model developed recently by Koussis. It covers the widest range of practical applications, excluding only cases where dynamic effects or downstream disturbances play a major role. Other features were reviewed which make the Koussis model an ideal framework for the development of generalized computer programs for approximate flood routing computations. (Singh-ISWS)
W80-04208

THE RIVER CONTINUUM CONCEPT,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
R. L. Vannote, G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushing.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 1, p 130-137, January 1980. 2 Fig, 38 Ref. NSF BMS75-07333, DEB78-11671.

Descriptors: *Rivers, *Ecosystems, *Geomorphology, *Biological communities, Biology, Biomass, Invertebrates, Aquatic microbiology, Streams, Streamflow, Environment, Aquatic environment, River continuum, Ecosystem stability, River zonation.

From headwaters to mouth, the physical variables within a river system present a continuous gradient of physical conditions. This gradient should elicit a series of responses within the constituent populations resulting in a continuum of biotic adjustments and consistent patterns of loading, transport, utilization, and storage of organic matter along the length of a river. Based on the energy equilibrium theory of fluvial geomorphologists, it was hypothesized that the structural and functional characteristics of stream communities are adapted to conform to the most probable position or mean state of the physical system. The authors reasoned that producer and consumer communities characteristic of a given river reach become established in harmony with the dynamic physical conditions of the channel. In natural stream systems, biological communities can be characterized as forming a temporal continuum of synchronized species replacements. This continuous replacement functions to distribute the utilization of energy inputs over time. Thus, the biological system moves towards a balance between a tendency for efficient use of energy inputs through resource partitioning (food, substrate, etc.) and an opposing tendency for a uniform rate of energy processing throughout the year. It was theorized that biological communities developed in natural streams assume processing strategies involving minimum energy loss. Downstream communities are fashioned to capitalize on upstream processing inefficiencies. Both the upstream inefficiency (leakage) and the downstream adjustments seem predictable. The authors proposed that this River Continuum Concept provides a framework for integrating predictable and observable biological features of lotic systems. Implications of the concept in the areas of structure, function, and stability of riverine ecosystems were discussed. (Sims-ISWS)
W80-04222

LEAF LITTER PROCESSING IN A REGULATED ROCKY MOUNTAIN STREAM,
Colorado State Univ., Fort Collins.
R. A. Short, and J. V. Ward.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 1, p 123-127, January 1980. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Leaves, *Streams, *River regulation, *Rocky Mountain Region, *Colorado River, Mountains, Rivers, Litter, Invertebrates, Temperature, Water temperature, Dams, Streamflow, Biology, *Leaf litter processing.

Processing of alder (Alnus tenuifolia) was investigated during autumn and winter to determine the influence of stream regulation on leaf litter processing. Study sites were the Colorado River below Granby Dam and the Fraser River, an unregulated tributary. Alder leaves (5-g units) were attached to bricks and placed in riffles. Leaching controls were retrieved after 48 h; thereafter five replicates were collected from each site after 17, 38, 52, and 66 d. There were significant differences (P less than 0.05) in processing rates between sites. The loss rate coefficient (k) was much higher ($k = 0.0462$) for leaves incubated in the regulated section of the Colorado River than for those in the unregulated tributary ($k = 0.0235$). The hypothesis that reductions in macroinvertebrate shredders would decrease processing rates of leaf litter in regulated streams was not supported by the results. The 'winter warm' thermal regime below the reservoir seemed to compensate for the virtual absence of shredder species apparently by enhanced microbial processing. (Sims-ISWS)
W80-04223

EFFECTIVE RAINFALL ESTIMATION,
Technical Univ. of Prague (Czechoslovakia). Dept. of Irrigation and Drainage.
For primary bibliographic entry see Field 2G.
W80-04231

CONSTANT-RAINFALL INFILTRATION,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
For primary bibliographic entry see Field 2G.
W80-04232

CHARACTERIZATION AND MODELS OF WATERSHED STORAGE,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao, P. C. Tao, and C. Rukvichai.
Journal of Hydrology, Vol 45, No 3/4, p 253-277, February 1980. 15 Fig, 6 Tab, 18 Ref. DACW 27-74-C-0072.

Descriptors: *Watershed(Basins), *Rainfall-runoff relationships, *Kentucky, Soil moisture, Hydrology, Time series analysis, Statistical models, Temperature, Streamflow, Evapotranspiration, Precipitation(Atmospheric), Fourier analysis, *Watershed storage, Stochastic models.

Precipitation and runoff are usually the only variables considered in forecasting runoff from watersheds by stochastic models. However, the degree of saturation of watersheds strongly affects statistical characteristics of daily runoff. Watershed storage series, which indicate the degree of saturation of a watershed, were analyzed, and the results were presented. The data from four watersheds in the Green River basin in Kentucky were analyzed. After a discussion of characteristics of the basic data, the watershed storage series was computed and its spectrum, correlogram, and other characteristics were discussed. Stochastic models were developed for the watershed storage series, and their prediction capability was analyzed. Daily watershed storage is a highly correlated seasonal variable which can be forecast a few days ahead with great accuracy. The utility of the watershed storage series in forecasting runoff was briefly discussed. (Lee-ISWS)
W80-04233

MODELLING AND ANALYSIS OF DATA FROM CATCHMENT STUDIES OF LAND USE CHANGE,
National Research Advisory Council of New Zealand, Wellington.
For primary bibliographic entry see Field 2A.
W80-04254

NITRATE REMOVAL FROM STREAMS DRAINING EXPERIMENTAL CATCHMENTS,
Ministry of Works and Development, Hamilton (New Zealand). Hamilton Science Centre.
For primary bibliographic entry see Field 5B.
W80-04265

EFFECTS OF INCREASED LAND-USE UPON FRESHWATERS IN THE CENTRAL HIMALAYAS,
Kumaun Univ., Naini Tal (India). MAB/DST Lakes Project.
S. M. Das.
Progress in Water Technology, Vol 11, No 6, p 195-208, 1979. 6 Tab, 2 Ref.

Descriptors: *Land use, *Runoff, *Floods, *Mountains, Effects, Sediments, Erosion, Rainfall, Monsoons, Water pollution, Lakes, Eutrophication, Crops, Vegetation, Roads, Road construction, Geology, Glaciers, Rivers, *India, *Himalaya Mountains.

More than 80% of the total 1500 mm/year rainfall in the Indian Central Himalayas occurs during the monsoon months of June to September, when high intensity rains and cloudbursts are common. There is excessive runoff due to diminishing forest cover, unguarded terrace fields, steep and barren slopes, and periodic seismic phenomena, causing serious erosion, loss of top soil, leaching of the meagre soil nutrients, and high floods. The runoff carries a heavy silt load that causes rapid siltation of dams, reservoirs, rivers, and lakes. Construction of new roads extending across the hills has also caused extensive deforestation and landslides which have greatly increased the already severe problems of siltation and floods. In addition, the lakes of the Central Himalayas are becoming eutrophic and highly polluted due to increased human settlement and poor sanitation. The recent high floods in the Gangotri-Bhagirathi-Alakhnanda-Ganga basin and in the Jamunetri-Jamuna basin, have been caused partially by excessive rainfall in August 1978, but mainly by the siltation of streams and rivers during the last century. Some immediate preventive and remedial measures against destructive floods in the Central Himalayas are presented. (Sims-ISWS)
W80-04312

QUANTITATIVE DETERMINATION OF THE SUBGLACIAL HYDROLOGY OF TWO ALPINE GLACIERS,
Manchester Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-04338

SUBGLACIAL CONSTRUCTIONS AND INVESTIGATIONS AT BONDHUSBREEN, NORWAY,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 2C.
W80-04339

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1974 THROUGH SEPTEMBER 1977,

Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04371

THE CALIFORNIA WATER ATLAS.
California Office of Planning and Research, Sacramento.
For primary bibliographic entry see Field 2A.
W80-04444

2F. Groundwater

APPLICATION OF RECENT RESULTS IN FUNCTIONAL ANALYSIS TO THE PROBLEM OF WATER TABLES,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Advances in Water Resources, Vol 2, No 4, p 185-190, December 1979. 7 Ref.

Descriptors: *Darcys law, *Water table, *Hydrodynamics, *Potential flow, *Theoretical analysis, Mathematics, Analysis, Continuity equation, Groundwater, Porous media, Interfaces, Singularities, Singular surfaces.

The traditional viewpoint in hydrology and soil physics purports that water tables appearing in porous media described by Darcy's law and the extended Darcy's law are not singular surfaces. Several particular solutions in which singularities occur were presented as counter-examples to the traditional viewpoint and as evidence supporting the new theory that water tables are generally singular surfaces. (Adams-ISWS)
W80-04214

THREE-DIMENSIONAL SEEPAGE THROUGH A HOMOGENEOUS DAM,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. Caffrey, and J. C. Bruch, Jr.
Advances in Water Resources, Vol 2, No 4, p 167-176, December 1979. 7 Fig, 11 Ref.

Descriptors: *Numerical analysis, *Finite element analysis, *Free surfaces, Porous media, Dams, Analysis, Water table, Seepage, Potential flow, *Three-dimensional flow, *Finite difference analysis, Stream functions.

Seepage flow through a homogeneous earth dam is a free surface flow phenomenon. Because of the shape of the dam, a two-dimensional analysis may not be appropriate and a three-dimensional analysis would be required. Such situations were investigated using the Baiocchi method and transformation. Algorithms using finite difference and finite element successive over-relaxation methods with projection were formulated. The solution to several example cases were presented with a discussion of the approach. (Adams-ISWS)
W80-04215

ORGANIC CONTAMINANT BEHAVIOR DURING GROUNDWATER RECHARGE,
Stanford Univ., CA.
For primary bibliographic entry see Field 5A.
W80-04219

KARSTIC SPRING RECESSION HYDROGRAPH AND WATER TEMPERATURE ANALYSIS: OYMAPINAR DAM PROJECT, TURKEY,
J. Karanjac, and A. Altug.
Journal of Hydrology, Vol 45, No 3/4, p 203-217, February 1980. 6 Fig, 6 Ref.

Descriptors: *Karst, *Springs, *Sinks, *Dams, *Leakage, Tracers, Fluorescent dye, Velocity, Groundwater movement, Transmissivity, Water temperature, Groundwater recharge, Recession curves, Hydrographs, Water circulation, Limestones, Base flow, Karst hydrology, Discharge(Water), Depth, Geologic control, *Turkey, Hydraulic regime.

Karstic springs downstream of the high Oymapinar Dam, Turkey, which is under construction, were a cause of concern for eventual leakage of the Oymapinar Reservoir. Springwater temperatures were evaluated to indicate the depth of circulation and, implicitly, the extent of karstification. The evaluation of the temperature record, coupled to the interpretation of the spring recession hydrograph, was used to formulate the hypotheses for the recharge areas of the springs, transmissivity of the system, size of the system, and hydraulic regime of the springs. (Visocky-ISWS)
W80-04234

DISPERSIVITY AND VELOCITY RELATIONSHIP FROM LABORATORY AND FIELD EXPERIMENTS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg bei Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
D. Klotz, K-P. Seiler, H. Moser, and F. Neumaier.
Journal of Hydrology, Vol 45, No 3/4, p 169-184, February 1980. 10 Fig, 3 Tab, 16 Ref.

Descriptors: *Dispersion, *Velocity, *Laboratory tests, *On-site tests, Porous media, Hydraulics, Sediments, Sands, Gravels, Groundwater, Observation wells, *Dispersivity, Longitudinal dispersion, Grain-size distribution.

Laboratory test results on longitudinal dispersion of soluble material in loose rocks with artificially composed or natural grain-size distributions were compared with one another and with results of field tests. In this way it can be demonstrated that it is quite possible to translate laboratory results to field conditions, if sedimentological properties of the loose materials are comparable, if bedding (geological interfaces) runs parallel to the flow direction and is hydraulically ineffective, and if distances between injection and detection are about less than 50 m. Transverse dispersion is difficult to determine. At first approximation the width of tracer cloud from a line injection was determined and the aperture angle of the resultant cloud calculated. The laboratory and field experiments showed an aperture angle of about 5 degrees on distances between 10 and 2500 m. (Lee-ISWS)
W80-04235

ESTIMATION OF RECHARGE TO THE PHREATIC AQUIFERS OF THE LOWER MANER BASIN, INDIA, BY USING THE TRITIUM INJECTION METHOD,
National Geophysical Research Inst. Hyderabad (India).
R. N. Athavale, C. S. Murti, and R. Chand.
Journal of Hydrology, Vol 45, No 3/4, p 185-202, February 1980. 6 Fig, 6 Tab, 10 Ref.

Descriptors: *Groundwater recharge, *Water table aquifers, *Tracers, *Tritium, Aquifers, Groundwater, Monsoons, Sampling, Moisture content, Depth, Soil profiles, *India.

Recharge to the phreatic aquifers in seven different geological formations of Lower Maner Basin, Andhra Pradesh, which forms a part of the Godavari Rift Valley, has been measured by using the tritium tagging method. Twenty-eight sites, covering an area of approximately 1575 sq km, were selected on the basis of geology, topography, drainage pattern, and soil types of the basin. Tritium injections, at 70 cm depth, were made before the commencement of the monsoon rains in June 1976. Soil core samples, in 10-cm sections, were collected from the injection sites in December 1976, i.e., after completion of the monsoon rains. Variation in tritium activity and moisture content with depth, in each soil profile, was measured for estimation of tracer movement and calculation of recharge. The recharge values over Kota claystones and Pakhal shales were found to range from 7 to 12 cm, with an average value of 9.6 cm. In Kamthi sandstones, which also contain some shaly facies, the recharge was found to vary from 7 to 24 cm, with a mean value of 12.7 cm. The total annual input to groundwater reserves of the phreatic aquifers of the basin was estimated as 152,000,000 + or - 15,000,000 cu m. This amounts to approximately 8% of the average annual rainfall of 125 cm over the basin. (Visocky-ISWS)
W80-04249

GROUNDWATER TRANSPORT OF A SALT TRACER THROUGH A SANDY LAKEBED,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
For primary bibliographic entry see Field 2A.
W80-04250

AGRICULTURAL LAND USE AND ITS EFFECT ON CATCHMENT OUTPUT OF SALT AND WATER--EVIDENCE FROM SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
D. R. Williamson, and E. Bettenay.
Progress in Water Technology, Vol 11, No 6, p 463-480, 1979. 7 Fig, 4 Tab, 39 Ref.

Descriptors: *Land clearing, *Groundwater, *Recharge, *Salinity, *Australia, Salts, Runoff, Streamflow, Seepage, Water quality, Vegetation effects, Watersheds(Basins), Climates, Soils, Rainfall, Infiltration, Agriculture, Land use, Salt balance, Clearing effects.

Agricultural development over the past 200 years in southern Australia has involved extensive clearing of the native, evergreen vegetation and its replacement with annual rain-fed crops and pastures. These introduced plants have a limited growing season, are comparatively shallow rooted, and hence, in a Mediterranean climate, use less water. A consequence of this is the secondary salinization of about 277,000 ha of previously productive land and associated degradation of valuable water resources. These effects were first noted in the 1890s, and by 1924 it was hypothesized that increased recharge caused a rise in levels of saline underground water bringing salts to the soil surface particularly near water courses. Studies initiated in the 1960s have shown that large quantities of soluble salts are stored in the deep weathering zones characteristic of southern Australia. Under forested conditions, surface and near surface waters are relatively fresh, although deeper groundwaters may be highly saline. Data presented showed that groundwaters rise as a consequence of clearing. This leads to the development of saline seeps, which, together with an increase in saline baseflow, results in increased salt export from catchments. Although there is usually a concomitant increase in runoff, this may not be sufficient to keep annual stream salinity below an acceptable level. The pattern of changes in streamflow quality during the year was shown to provide an indicator of the contribution of saline baseflow to streams from small catchments. This may be useful in predicting the effect of clearing, or in indicating a decline in saline baseflow following re-afforestation. (Sims-ISWS)
W80-04259

THE EFFECTS OF LAND USE AND HYDROLOGY ON GROUNDWATER QUALITY IN MID-CANTERBURY, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Ashburton (New Zealand). Winchmore Irrigation Research Station.
For primary bibliographic entry see Field 5A.
W80-04261

THE EFFECTS OF IRRIGATION WITH MEATWORKS-FELLMONGERY EFFLUENT ON WATER QUALITY IN THE UNSATURATED ZONE AND SHALLOW AQUIFER,
Canterbury Frozen Meat Co. Ltd. Christchurch (New Zealand).
For primary bibliographic entry see Field 3C.
W80-04262

THE HYDROCHEMISTRY OF AN AQUIFER NETWORK,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Use Research.
For primary bibliographic entry see Field 2K.

W80-04263

NITRATE AND CHLORIDE IN GROUNDWATER, SURFACE WATER AND DEEP SOIL PROFILES OF CENTRAL CANTERBURY, NEW ZEALAND,
Lincoln Coll., (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5A.
W80-04264

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, II. EVAPORATION FROM ATRIPLEX PLANTATIONS OVER A SHALLOW SALINE WATER TABLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2D.
W80-04273

MODEL APPLICATION TO URBAN GROUNDWATER PROBLEMS OF FAIRBANKS, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-166465, Price codes: A03 in paper copy, A01 in microfiche. Completion Report No 76-2, January 1980. 30 p, 7 Fig, 1 Tab, 20 Ref, 1 Append. OWRT B-033-ALAS(1).

Descriptors: *Alaska, *Groundwater recharge, *Frozen soils, *Permafrost, Frozen ground, Pumping, Model studies, Mathematical studies, Snowmelt, Precipitation(Atmospheric), Groundwater barriers, Groundwater movement, Tundra, Thawing.

The role of frozen soils in northern groundwater systems is examined and modeled. The combination of relatively dry climates, frozen soils, and increased use of groundwater is creating new stresses on the groundwater systems of northern areas such as Alaska where declining water levels are reported. To study the regional effects of pumping, a model was developed that uses the transient equation for liquid water transport in the soil. This water transport is created by hydraulic gradients in the soil. Two cases were simulated with the model, a single layered organic only case and a double layered organic and mineral case. Results of the model give an indication of the potential for recharge in a region. Factors accounted for in the model include: distribution of soil water, soil conditions, slope, and input rate. Results of the model application show that in the interior of Alaska the potential for groundwater recharge from precipitation is limited. This is due to both the pattern of precipitation and soil conditions. Prolonged rainfall or snowmelt is needed for significant recharge. Model results from a snowmelt show that frozen soil with a low moisture content of about 10% behaves much like dry unsaturated soil while very wet frozen soils are considered impermeable. Model equations and other results are given. (Seigler-IPA)
W80-04295

GROUNDWATER UTILIZATION, SOUTH FORK OF LONG ISLAND,
G. F. Pinder, and R. H. Page.
Clearwaters, Vol 9, No 4, p 11-14, December 1979. 7 Fig, 7 Ref.

Descriptors: *Mathematical models, *Aquifer characteristics, *Groundwater resources, Seepage, Groundwater movement, Water level fluctuations, Pumping, Infiltration, Saline water, Saline water-freshwater interfaces, Water levels, Water wells, Water supply development.

Two mathematical models developed to predict groundwater system responses to pumpage and development on the South Fork of Long Island are briefly described. The aquifer has a pillow of fresh water underlain by denser saline water. Fresh water flows outward toward the sea by coastal seepage and is replaced by natural recharge from precipitation and groundwater streams. Any changes in this balance of inflow and outflow such as a drought or pumpage results in a lower equilibrium thickness and could result in salt water being drawn up into wells depending on their location and depth. The models developed to study various pumpage situations use nonlinear partial differential equations solved numerically with finite elements. The regional model simulates variability in the two horizontal space dimensions, while the other model, the local model, studies pressures and concentrations near a well. The local model, which is used to predict the salinity of water from a particular well, is based on equations describing the density-dependent groundwater flow and the convective and dispersive transport of a solute. System inputs and parameters for the regional model, the hydrogeologic properties of the aquifer and inflow-outflow rates, were gathered in 1975-1976 and the model was calibrated to allow for errors in data. Data from a drought period in the 1960's were used for forecasting the impact of proposed withdrawals. Most of the pumpage options simulated were found to have acceptable regional impact. (Seigler-IPA)
W80-04302

HYDROLOGIC DATA FOR THE MORRIS BRIDGE WELL-FIELD AREA, HILLSBOROUGH COUNTY, FLORIDA, 1971-78,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. D. Duerr.
Available from: OFSS Bx 25425 Fed. Ctr. Denver, CO, paper copy $10.25 microfiche $3.50. Geological Survey open-file report 79-1262, 1979. 76 p, 9 Fig, 5 Tab, 8 Ref.

Descriptors: Hydrologic data, *Well data, *Florida, *Groundwater, *Data collections, Test wells, Aquifer characteristics, Monitoring, Networks, Streams, Hydrographs, Water levels, Streamflow, Rainfall observation wells, Water yield, Drawdown, *Hillsborough County(Fla).

Well data are summarized for 102 wells constructed in the Morris Bridge well-field area in north-central Hillsborough County. Of the wells reported, 20 are public-supply wells that have yields averaging 1,800 gallons per minute and specific capacities that range from 36 to 346 gallons per minute per foot of drawdown. Also presented are 28 drillers' logs, 7 lithologic logs, and an index of 64 geophysical logs of 18 wells in the well-field area. The report also includes hydrographs of water levels of 10 observation wells, hydrographs of stream stage and streamflow of the Hillsborough River, and hydrographs of rainfall for two stations. (Kosco-USGS)
W80-04372

WATER RESOURCES OF THE SANTA ROSA INDIAN RESERVATION AND VICINITY, RIVERSIDE COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04376

RESULTS OF TRANSIENT SIMULATIONS OF A DIGITAL MODEL OF THE ARIKAREE AQUIFER NEAR WHEATLAND, SOUTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04379

JANUARY 1979 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Geological Survey open-file report 79-925, May 1979. 213 p, 3 Tab.

Descriptors: *Groundwater, *Water levels, *Observation wells, *Kansas, *Water level fluctuations, Irrigation, Seasonal, Groundwater recharge, Aquifers, Hydrogeology, Western Kansas, South-central Kansas.

Water-level measurements were made in about 1,300 observation wells in 35 counties as part of an annual inventory of ground-water conditions in western and south-central Kansas. The measurements were made in mid-winter, mostly in January 1979, when pumping was minimal and water levels had recovered from the effects of pumping during the previous irrigation season. Tables in this report show the depths to water in 1940, 1944, or 1950 (the predevelopment years), 1966 (a year of abnormally high rainfall), 1978 and 1979; water-level declines from 1940-79, or 1950-79, from 1966-79, 1974-79, or 1978-79; and average annual declines from 1940-79, 1944-79, or 1950-79 and from 1966-79. Also shown are saturated thicknesses of the deposits in 1940, 1944, or 1950 and in 1979, as well as the percentage change in saturated thickness from 1940-79, 1944-79, or 1950-79. (Kosco-USGS)
W80-04380

HYDROLOGIC AND GEOLOGIC DATA FROM THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. L. Miller.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO 80225, Paper copy $13.25, Microfiche $3.50. Geological Survey open-file report 79-1543, 1979. 99 p, 2 Fig, 6 Tab.

Descriptors: *Hydrologic data, *Hydrogeology, *Water resources, *Planning, *Florida, Investigations, Well data, Aquifers, Lithologic logs, Water levels, Groundwater, Water quality, Water resources development, *Southeast Florida.

The Upper East Coast Planning Area, one of five designated planning areas in the South Florida Water Management District, consists of St. Lucie, Martin, and eastern Okeechobee Counties. Existing hydrologic and geologic data have been compiled as a base for additional investigations to determine the water-bearing characteristics of the shallow aquifer system in the area. These data include lithologic logs from 51 wells in excess of 90 feet in depth, periodic ground-water levels from 100 wells, and ground-water levels from 100 wells, and ground-water quality data from 93 wells. (Kosco-USGS)
W80-04381

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE NOWOOD RIVER DRAINAGE AREA, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley, and W. J. Head.
Geological Survey open-file report 79-1291 (WRI), 1979. 55 p, 4 Fig, 2 Plates, 11 Tab, 9 Ref.

Descriptors: *Groundwater resources, *Wyoming, *Aquifer characteristics, *Water yield, *Alluvium, Water wells, Alluvial aquifers, Hydrogeology, Surface-groundwater relationships, Rocky Mountain region, Streamflow, Groundwater recharge, Flood plains, Irrigation, Chemical analysis, Maps, *Bighorn Basin(Wyo), *Norwood River drainage area(Wyo).

In the Nowood River drainage area, Wyoming, the principal deposits comprising the alluvial aquifer include the flood-plain and younger (generally undissected) alluvial-fan deposits and a unique boulder-fan gravel. Other deposits mapped, but virtually nonwater yielding, are the older (dissected) alluvial-fan, pediment, and terrace deposits. Terraces are capped by gravel and form levels at 30-40, 45-100, 120-150, 200-260, and 280-330 feet above the Nowood River. The thickness of the alluvial aquifer indicated from the sparse well-log data and 42 surface resistivity measurements is between 25 and 50 feet along the Nowood River and more than 60 feet along Tensleep and Paint Rock

Creeks. The resistivity measurements indicate a buried bedrock ridge below the boulder-fan gravel between Paint Rock and Medicine Lodge Creeks and a buried channel filled by alluvium along Tensleep Creek. Well yields from the alluvial aquifer are estimated to be low. The most favorable areas for ground-water development are from the flood-plain alluvium along Tensleep Creek and from the boulder-fan gravel and adjoining flood-plain alluvium along Paint Rock and Medicine Creeks. Along the Nowood River the flood-plain alluvium, although its yields are small, has the best potential for ground-water development. (Kosco-USGS)
W80-04382

2G. Water In Soils

RUNOFF CURVE NUMBERS FROM PARTIAL AREA WATERSHEDS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W80-04207

EFFECTIVE RAINFALL ESTIMATION,
Technical Univ. of Prague (Czechoslovakia). Dept. of Irrigation and Drainage.
J. Mls.
Journal of Hydrology, Vol 45, No 3/4, p 305-311, February 1980. 3 Fig, 5 Ref.

Descriptors: *Precipitation excess, *Effective precipitation, *Runoff, Rainfall, Runoff coefficient, Runoff forecasting, Infiltration rates, Infiltration, Surface runoff, Hydrology, Soil moisture, Ponding, *Asymptotic infiltration rate, Water ponding, Time of ponding.

A method for estimating the rainfall effective in generating runoff was presented which is based on the infiltration process. With the use of the known equations that describe the ponding infiltration rate in time, a functional relationship between the cumulative infiltration and the maximum possible infiltration rate was stated. Based on that statement the equation of infiltration rate such as it occurs during a general rainfall, was derived, and the infiltration envelope curve was defined. The theory was applied to the evaluation of infiltration from rain of constant intensity, and the results were compared with the numerical analysis of Smith, offering a good agreement. The method was further used to determine the effective rainfall for a given rain of nonconstant intensity. (See also W73-04376) (Lee-ISWS)
W80-04231

CONSTANT-RAINFALL INFILTRATION,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
M. Kutilek.
Journal of Hydrology, Vol 45, No 3/4, p 289-303, February 1980. 7 Fig, 2 Tab, 23 Ref.

Descriptors: *Infiltration, *Runoff, *Infiltration rates, Runoff coefficient, Soil moisture, Ponding, Moisture content, Hydrology, Rainfall, *Ponding time, Moisture profile, Infiltration equation.

An approximate solution of the infiltration equation for rain of constant intensity was developed. From the theory, the ponding time and the development of the moisture profile at time shorter than ponding time were determined. Using the theoretical background, simple empirical and algebraic equations were derived for the calculation of the ponding time. The solutions were compared with the results of the numerical analysis; good agreement was found. The solution of the infiltration for time greater than ponding time was obtained either for 'delta function' soil or for an empirical infiltration equation. (Lee-ISWS)
W80-04232

ESTIMATION OF SOIL MOISTURE AT DEEPER DEPTH FROM SURFACE LAYER DATA,
Meteorological Office, Poona (India).
B. C. Biswas, and S. K. Dasgupta.
Mausam, Vol 30, No 4, p 511-516, October 1979. 7 Fig, 2 Tab, 6 Ref.

Descriptors: *Soil moisture, *Estimating, *Model studies, Mathematical models, Estimating equations, Soil water, On-site investigations, Soils, Soil types, Rainfall, Infiltration, Soil water movement, Agriculture, Regression analysis, Soil science, *India.

In situ measurements of soil moisture at deeper layers is very difficult especially in heavy soils. Regression equations have, therefore, been developed to estimate in the clear season soil moisture variations at deeper layers from fluctuation of soil moisture in the surface layer. Estimated values were compared with observed values. The estimates were reasonably accurate. (Sims-ISWS)
W80-04236

A STUDY ON WATER AVAILABILITY TO THE CROPS GROWN UNDER RAINFED CONDITIONS IN DIFFERENT SOILS AT BIJAPUR,
University of Agricultural Sciences, Bangalore (India).
B. V. Ramana Rao, B. R. Biradar, S. S. Surpur, M. Gopinatha Rao, and T. Satyanarayana.
Mausam, Vol 30, No 4, p 469-472, October 1979. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Soil water, *Soil moisture, *Evapotranspiration, Soils, Soil types, Crops, Rainfall, Water storage, Drainage, Evaporation, Agriculture, Meteorology, Climatology, Soil science, *India, Water availability.

The soil moisture available in the red sandy soils, red loams, medium black soils, and deep black soils at Bijapur was estimated using a simple climatic water balance model. As the ratio of actual evapotranspiration to the potential evapotranspiration gives the rate at which water is supplied compared to the demand for water, the values of the ratio A sub E/P sub E with 40, 60, and 80% probabilities in different soils were presented. The planting schedules for short, medium, and long duration crops were worked out, and the chances of sowing the crops of different durations during the optimum sowing periods were given. (Sims-ISWS)
W80-04239

THE EFFECTS OF IRRIGATION WITH MEATWORKS-FELLMONGERY EFFLUENT ON WATER QUALITY IN THE UNSATURATED ZONE AND SHALLOW AQUIFER,
Canterbury Frozen Meat Co. Ltd. Christchurch (New Zealand).
For primary bibliographic entry see Field 3C.
W80-04262

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, II. EVAPORATION FROM ATRIPLEX PLANTATIONS OVER A SHALLOW SALINE WATER TABLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2D.
W80-04273

AUTOMATIC MEASUREMENT OF SOIL-WATER PRESSURE USING A CAPACITANCE MANOMETER,
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
For primary bibliographic entry see Field 7B.
W80-04305

PHOSPHORUS IN A MODEL POND STUDY: I SEDIMENT SELECTION AND PREPARATION,
Science and Education Administration, Durant, OK. Water Quality Management Lab.
For primary bibliographic entry see Field 5C.
W80-04343

2H. Lakes

WATER MANAGEMENT, WATER QUALITY AND ENGINEERING GEOLOGY STUDY OF SELECTED OXBOW LAKES AS THEY MAY BE IMPACTED BY DREDGING -- PHASE II,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. A. Lohnes, R. W. Bachmann, and T. A. Austin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164692, Price codes: A06 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University Completion Report No ISWRRI-103, ISU-ERI-AMES-80085, October 1979. 106 p, 21 Fig, 16 Tab, 45 Ref. OWRT A-066-IA (1).

Descriptors: *Iowa, *Oxbow lakes, *Dredging, *Sedimentation, Lake morphology, Lake morphometry, Lake sediments, Geomorphology, Water quality, Perched water, Groundwater, Hydrogeology, Erosion, Hydrology, Pumping, Wells.

Seven oxbow lakes located on the Missouri River floodplain in Iowa were studied to determine their value and water quality characteristics and to evaluate alternate water management improvement programs. The lakes studied were Lake Quinnebaugh, a shallow marsh; Badger Lake with extensive areas of aquatic vegetation; DeSoto Bend, a man-made cutoff; Carter Lake; Lake Manawa; Brown's Lake; and Blue Lake. Brown's Lake, Blue Lake, Lake Manawa, and DeSoto Bend are used extensively for recreation and were intensively studied. Data were gathered on lake morphometry, history, sedimentation, hydrology, and water quality. Results show that since these lakes were first cut off in the 1800's they have decreased to about 40% of their original area. This decrease is mostly due to lower groundwater tables rather than the common belief that extensive sedimentation has occurred. The lakes are perched and low-permeability silt and clay sediments seal the bottom to retard outward flow although there is a general outward flow gradient for most of the lakes. If dredging is used as a management technique care must be taken to prevent the destruction of this seal. Supplemental pumpings of groundwater appear to be a feasible management technique but well location should be carefully selected. Specific recommendations are given for the various lakes. (Seigler-IPA)
W80-04203

EFFECT OF AGRICULTURE ON CEDAR LAKE WATER QUALITY,
Illinois State Water Survey, Urbana.
D. P. Roseboom, R. L. Evans, and T. E. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164619, Price codes: A04 in paper copy, A01 in microfiche. ISWS Circular 138, 1979. 61 p, 42 Fig, 32 Tab, 79 Ref.

Descriptors: *Lakes, *Illinois, *Water quality, *Agricultural watersheds, *Water pollution sources, Aquatic environment, On-site investigations, Data collections, Limnology, Water pollution, Effects, Pesticides, Organic pesticides, DDT, Dieldrin, Lake sediments, Heavy metals, Water chemistry, Dissolved oxygen, Analysis, Algae, Benthos, Water temperature, Lead, Copper, Zinc, Iron, Mercury, Arsenic, Secchi disks, Alkalinity, Hardness(Water), Phosphorus, *Carbondale(IL), *Cedar Lake(IL).

This study was made to delineate the type, distribution, and magnitude of orchard-related pesticides in the aquatic environment of Cedar Lake which includes the older impoundments of Little Cedar Lake and the Alto Pass Reservoir. Cedar Lake is a source of water supply for Carbondale, Illinois. The study included analyses for mineral and pesticide content of the soils, the water and bottom muds of the three lakes, and the water and sediments of the four major tributaries. In addition, the general limnology and biological characteris-

tics of Cedar Lake were defined, sedimentation surveys of the two older lakes were performed, and relevant data regarding pesticide content in fish were evaluated. The results showed that application of pesticides in well-sodded orchards does not pose a serious threat to the water quality of Cedar Lake, but a threat does exist when such orchard lands are converted to row crops, subdivisions, or other uses that destroy the sod cover that minimizes soil erosion. Pesticide residues that make their way by soil movement to the aquatic environment do accumulate in the bottom muds of the lakes, and may become solubilized and thus transferred to the lake waters. The waters of Cedar Lake stratify in summer resulting in depletion of dissolved oxygen in the lower 15 feet of water. Lake management to minimize such oxygen depletion is needed to control taste and odors and the introduction of undesirable metals in the water supply. The sedimentation surveys showed that soil loss on the watershed is excessive and that soil erosion prevention procedures are needed. The desirable game fish in the lakes contain mercury concentrations in excess of FDA tolerance limits despite the fact that mercury in excess of background levels was not found in the soils, suspended sediment, nor lake bottom sediments in the watershed. Research as to possible effects of inundated vegetation on the transfer of mercury from water to fish is suggested. DDT and dieldrin in fish are not a cause for concern in the Cedar Lake watershed. (Humphreys-ISWS)
W80-04206

COUPLING OF INTERNAL WAVE MOTION WITH ENTRAINMENT AT THE DENSITY INTERFACE OF A TWO-LAYER LAKE,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
R. H. Spigel.
Journal of Physical Oceanography, Vol 10, No 1, p 144-155, January 1980. 3 Fig, 17 Ref.

Descriptors: *Lakes, *Waves(Water), *Internal waves, *Model studies, Mathematical models, Density, Winds, Stratification, Equations, Energy, Pressure, Stress, Velocity, Entrainment, Limnology.

A solution was presented to the problem of a two-layer rectangular basin subject to a suddenly applied, uniform wind stress; Coriolis effects were ignored. The solution was obtained for the case in which the time scales of internal wave motion, wave decay, and entrainment are widely separated; in this range the entrainment across the interface is a perturbation on the mean motions. The solution included an oscillatory initial response, followed by wave decay and a steady-state interface setup with baroclinic circulation, all superimposed on a slow deepening of the top layer by entrainment. The entrainment in turn affects the frequency of interfacial waves as the mixed layer deepens--the deepening alters top and bottom layer thickness and the density jump between them. For the range of mixed-layer Richardson number considered, entrainment is energized by wind stirring at the water surface, which does work at a rate proportional to (u*) cubed. (Sims-ISWS)
W80-04209

KINETICS OF RED CLAY BLUFF DISSOLUTION IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior.
For primary bibliographic entry see Field 2J.
W80-04216

ESTIMATES OF LAKE ST. CLAIR EVAPORATION,
National Oceanic and Atmospheric Administration, Ann Arbor. MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2D.
W80-04217

A SIMPLE REFLECTANCE METHOD FOR THE MEASUREMENT OF PARTICULATE PIGMENT IN LAKE WATER AND ITS APPLICATION TO PHOSPHORUS-CHLOROPHYLL-SESTON RELATIONSHIPS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
M. Bergmann, and R. H. Peters.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 1, p 111-114, January 1980. 3 Fig, 10 Ref.

Descriptors: *Phosphorus, *Chlorophyll, *Seston, *Lakes, Sampling, Analytical techniques, Pigments, Plant pigments, Light, Reflectance, Algae, Aquatic microorganisms, Filters, Membranes, Limnology.

This paper described a new method to measure total sestonic pigment based on the reduction in the amount of light reflected from a membrane filter after a given volume of lake water has passed through the filter. For a sample of 30 lakes, this index of 'reflectance' gave a better regression on total phosphorus than did chlorophyll which suggests that part of the variation in published phosphorus-chlorophyll relationships results from the association of phosphorus with pigments other than chlorophyll. But the residual variation suggested both that the amount of pigment developed per unit of phosphorus varies among lakes and that the index does not completely represent the seston. Relationships between reflectance and concentration of chlorophyll, phosphorus, and seston were good enough to suggest that this rapid, easy analysis may find application as an adjunct to more traditional analyses wherever membrane filters are routinely used in the analysis of lake water. (Sims-ISWS)
W80-04224

OXYGEN DEPLETION IN LAKE ERIE: HAS THERE BEEN ANY CHANGE,
Department of the Environment, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
M. N. Charlton.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 1, p 72-81, January 1980. 8 Fig, 1 Tab, 23 Ref.

Descriptors: *Oxygen, *Dissolved oxygen, *Hypolimnion, *Lake Erie, Temperature, Water temperature, Water levels, Climatology, Sampling, Data processing, Analytical techniques, Lakes, Eutrophication, Limnology, *Oxygen depletion rates.

A new analysis of hypolimnetic oxygen in central Lake Erie indicates that historic increases in the apparent depletion were not as great as formerly believed. The differences that did occur were mostly related to variations in hypolimnion thickness. Changes, if any, in the oxygen depletion rate due to eutrophication are as yet too small to be recognized. Present-day oxygen depletion rates, when corrected for the relatively high temperatures in Lake Erie, are within the range thought to be indicative of mesotrophy in small lakes. The general level of oxygen depletion observed in the central basin of Lake Erie is expected on the basis of morphology alone. (Sims-ISWS)
W80-04225

DYNAMICS OF DISSOLVED OXYGEN DURING ALGAL BLOOM IN LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ., Ikaraki (Japan). Inst. of Biological Sciences.
H. Seki, M. Takahashi, Y. Hara, and S. Ichimura.
Water Research, Vol 14, No 2, p 179-183, 1980. 4 Fig, 4 Tab, 14 Ref.

Descriptors: *Dissolved oxygen, *Algae, *Lakes, Nutrients, Solar radiation, Water temperature, Light, Phytoplankton, Chlorophyll, Bacteria, Nitrogen, Nitrogen compounds, Phosphorus, Oxygen, Water quality, Sampling, Limnology, Analytical techniques, Data processing. *Lake Kasumigaura(Japan).

Dynamics of dissolved oxygen during an algal bloom were studied in Lake Kasumigaura. Great amounts of oxygen arose from photosynthesis, and the concentration of dissolved oxygen reached 190% of saturation at 12 h. The majority of the dissolved oxygen produced was liberated into the atmosphere or consumed by microorganisms. Only minor fractions were transported into the dysphotic zone due to the low eddy diffusion coefficient in deeper waters of the euphotic zone. (Sims-ISWS)
W80-04242

EFFECTS OF RURAL AND URBAN SOURCES OF PHOSPHORUS OF LAKE BURLEY GRIFFIN,
Canberra Coll. of Advanced Education (Australia). School of Applied Science.
For primary bibliographic entry see Field 5B.
W80-04270

DESCRIPTIVE AND COMPARATIVE STUDIES OF MAINE LAKES,
Maine Univ. at Orono. Life Sciences and Agriculture Experiment Station.
R. B. Davis, J. H. Bailey, M. Scott, G. Hunt, and S. A. Norton.
University of Maine Life Sciences and Agriculture Experiment Station. Technical Bulletin No 88, March 1978. 337 p, 68 Fig, 33 Tab, 117 Ref, 5 Append.

Descriptors: *Lakes, *Maine, *Basic data collections, *Chemical properties, *Biological properties, Water chemistry, Water pollution sources, Trophic level, Oligotrophy, Phosphorus, Nitrogen, Phytoplankton, Zooplankton, Water pollution, Watersheds(Basins), Land use, Alkalinity, Chlorophyll, Coliforms.

Maine has 5,700 lakes greater than 0.4 ha in area; this descriptive and comparative study focused on 17 Maine lakes (22 basins). Lakes were sampled June 1970-May 1973. Watersheds are usually heavily forested (50-97%), but in southwestern Maine agricultural lands comprise significant percentages of the watersheds. Major point pollution sources exist at Haley Pond and Long Lake; otherwise, pollutants originate at shoreline cottages or from agricultural fields. Severe cultural eutrophication exists only in a few Maine lakes. Mean alkalinities range 4-27 ppm CaCO3, typical of oligotrophic-oligomesotrophic lakes. Mean total phosphorus ranges 2.4-27.8 ppb; phosphate concentrations range 0.2-4.0 ppb in surface waters. Mean inorganic fixed nitrogen ranges 32-190 ppb and averages 96 ppb. Mean phytoplankton cell counts range 140-30,700/ml; blue-green algae are most numerous and diatoms most voluminous. Mean sestonic chlorophyll-a values range 0.8-4.3 microg/l. The most numerous zooplankters are rotifers, especially Conochilus, Keratella and Kellicottia; mean values range 10-179 zooplankters/l. Mean Secchi disc transparency ranges 2.6-9.4 m. Maine lakes have an average of 11.9 cottages per km of shoreline. Lake water contamination by coliform bacteria occurs at numerous locations associated with cottages. Suitability of shoreline soils for septic disposal is poor or very poor at most locations. Open water mean counts are 4-7 FC/100 ml, unsuitable for drinking water purposes. (Danovich-Wisconsin)
W80-04286

ROLE OF SEDIMENTATION IN THE PHOSPHORUS BUDGET OF NATURAL AND ARTIFICIAL IOWA LAKES,
Iowa State Univ., Ames. Dept. of Animal Ecology.
R. W. Bachmann, and D. E. Canfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-166507, Price codes: A05 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University Completion Report No ISU-ERI-AMES-80030, September 1979. 101 p, 7 Fig, 11 Tab, 56 Ref. OWRT A-063-IA(1).

Descriptors: *Iowa, *Sedimentation rates, *Phosphorus, *Cycling nutrients, Lake stages, Mathematical models, Eutrophication, Limnology, Nutrients, Trophic level, Bottom sediments, Lake sediments, Chlorophyll, Secchi disks.

The limnological factors that influence sedimentation rates in natural and artificial lakes were studied and an empirical phosphorus model to predict

lake total phosphorus concentrations was developed and tested. Sediment traps were used to measure phosphorus sedimentation rates in four natural and four artificial Iowa lakes. While the sedimentation rates were found to be highly variable they were found to directly and significantly correlate with mean inorganic suspended matter concentrations and inorganic sedimentation rates. The rates measured in the Iowa lakes indicated that the lakes were losing from 5% to 60% of their total phosphorus daily. Since these lakes were not rapidly depleted of phosphorus as these rates would indicate it is probable that resuspension and resedimentation caused the traps to overestimate the net accumulation. Nutrient budget data from 290 natural and 433 artificial lakes in the U.S., Canada, and Europe, were used as a data base for a simple empirical phosphorus loading model that is based on the Vollenweider equation for input and output of phosphorus in lakes. The model was tested and found to predict lake total phosphorus concentrations equally well in both natural and artificial lakes. The model produces unbiased estimates of total phosphorus concentrations and has a 95% confidence interval of 31% to 288%. Due to the influence of allochthonous particulates in artificial lakes the model estimates for artificial lakes are less reliable. (Seigler-IPA)
W80-04294

FALLOUT PLUTONIUM IN AN ALKALINE, SALINE LAKE,
Lamont-Doherty Geological Observatory, Palisades, NY.
H. J. Simpson, R. M. Trier, C. R. Olsen, D. E. Hammond, and A. Ege.
Science, Vol 207, No 4435, p 1071-1073, March 7, 1980. 2 Tab, 29 Ref. DOE EY2529.

Descriptors: *Fallout, *Radioisotopes, *Lakes, *Saline lakes, Salinity, Alkalinity, Sediments, Freshwater, Chemicals, Water chemistry, Water pollution, Sampling, Pollutants, Chemical analysis, Limnology, *Mono Lake(CA), Plutonium.

Plutonium isotopes, derived from global fallout following atmospheric testing of nuclear weapons, were measured in the water and sediments of a natural alkaline, saline lake. The activities of fallout plutonium in the water column were about two orders of magnitude greater than in most freshwater lakes, where these nuclides are found predominantly in the sediments. (Sims-ISWS)
W80-04306

EFFECTS OF INCREASED LAND-USE UPON FRESHWATERS IN THE CENTRAL HIMALAYAS,
Kumaun Univ., Naini Tal (India). MAB/DST Lakes Project.
For primary bibliographic entry see Field 2E.
W80-04312

BIOLOGICAL OBSERVATIONS ON THE CRATER LAKES OF JEBEL MARRA, SUDAN,
Westfield Coll., London (England). Dept. of Zoology.
J. Green, A. I. El Moghraby, and O. M. M. Ali.
Journal of Zoology, Vol 189, No 4, p 493-502, December 1979. 6 Fig, 18 Ref.

Descriptors: *Craters, *Lakes, *Jebel Marra(Sudan), *Biological communities, *Salinity, *Oxygen sag, Ecological distribution, Ecotypes, Niches, Eutrophication, Phytoplankton, Zooplankton, Water temperature, Hydrogen ion concentration, Diatoms, Rotifers, Aquatic insects, Volcanoes, Africa, Mixing, Stratification, Winds.

Floral and faunal compositions in two crater lakes on the top of Jebel Marra, western Sudan, were studied in January 1976; differences in fauna observed between these two lakes is attributed to different salinity and oxygen regimes. Small Dariba Lake is shallow (11.5 m) and highly saline with even temperatures throughout the lake. Large Dariba Lake (108 m) is less saline and periodically exhibits temperature stratification. In the shallow lake oxygen is supersaturated in the upper 2 m but no oxygen occurs below 6 m except when strong winds mix the lake, creating 40% oxygen saturation throughout the water column. In the deep lake after strong winds, there is 12% saturation in the top 30 m. In both lakes pH fluctuates between 9.0-10.0. Phytoplankton in Large Dariba Lake consist of Spirulina geitleri and Anabaenopsis arnoldii. Diatoms (Melosira and Nitzchia) are the only phytoplankton present in Small Dariba Lake. Zooplankton Brachionus plicatilis, B. dimidiatus and Hexarthra jenkinae occur in both lakes. Individuals from nine insect orders are found in the smaller lake. A laviform aquatic lampyrid, or glow-worm, is also recorded in the small lake; this is the first account of an aquatic glow-worm in Africa. Poor faunas of these lakes are attributed to: isolation of the volcanic massif in an arid area, lake salinity, and unfavorable oxygen regimes. (Harris-Wisconsin)
W80-04350

A STATISTICAL MODEL FOR SMALL LAKE WATER QUALITY MANAGEMENT,
De Paul Univ., Chicago, IL.
For primary bibliographic entry see Field 5C.
W80-04359

LAKE MACROPHYTES AS THE FOOD OF ROACH (RUTILUS RUTILUS L.) AND RUDD (SCARDINIUS ERYTHROPHTHALMUS L.) I. SPECIES COMPOSITION AND DOMINANCE RELATIONS IN THE LAKE AND FOOD,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-04364

MONTHLY AND ANNUAL WATER BUDGETS OF LAKE WINGRA, MADISON, WISCONSIN, 1972-77,
Geological Survey, Madison, WI. Water Resources Div.
R. P. Novitzki, and B. K. Holmstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149842, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-100, November 1979. 31 p, 6 Fig, 9 Tab, 16 Ref.

Descriptors: *Hydrologic budget, *Lakes, *Wisconsin, *Wetlands, *Lake stages, Water quality, Precipitation(Atmospheric), Inflow, Discharge(Water), Evapotranspiration, Data collections, Lake Wingra(Wis).

This report presents estimated annual and monthly water budgets for Lake Wingra in Wisconsin and the adjacent wetland area for January 1972 through September 1977. Annually, inputs from precipitation, surface runoff, and ground-water inflow are approximately equal (31, 34, and 35 percent, respectively). Outputs include outflow from the lake into Murphy Creek (70 percent), evapotranspiration from the lake and wetland (26 percent) and ground-water outflow (4 percent). The inputs and outputs vary seasonally. In months when snowmelt occurs, surface runoff is a major input (56 percent in March; 46 percent in April). In fall and winter ground-water inflow is a major input (57 percent in November). Precipitation is 41 percent of the inflow in August, but only 18 percent in January. Lake outflow is the major output except in July, August, and September. Combined evaporation and evapotranspiration is a major output in summer (45 to 58 percent) but minor in winter (less than 13 percent). Ground-water outflow is a small part of the budget each month, ranging from 2 percent in March and April to a maximum of 7 percent in September. (Kosco-USGS)
W80-04369

STUDIES ON THE USEFULNESS OF DIFFERENT MESH-SIZE PLANKTON NETS FOR THICKENING ZOOPLANKTON,
Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-04445

DIATOM ASSOCIATIONS AND SUCCESSION IN LAKE KARIBA, SOUTH CENTRAL AFRICA,
University of the Witwatersand, Johannesburg (South Africa).
For primary bibliographic entry see Field 5C.
W80-04455

A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN EASTERN NORTH-CENTRAL, AND SOUTHEASTERN UNITED STATES.
National Eutrophication Survey, Corvallis, OR.
For primary bibliographic entry see Field 5C.
W80-04458

2I. Water In Plants

PLANT PATHOGENS AS AGENTS FOR BIOLOGICAL AND INTEGRATED CONTROL OF AQUATIC PLANTS,
Wisconsin Univ.-Madison. Dept. of Plant Pathology.
For primary bibliographic entry see Field 5B.
W80-04290

AMMONIUM UPTAKE BY SYMBIOTIC AND APOSYMBIOTIC REEF CORALS,
California Univ., Los Angeles. Dept. of Biology.
L. Muscatine, H. Masuda, and R. Burnap.
Bulletin of Marine Science, Vol 29, No 4, p 572-575, October 1979. 2 Fig, 13 Ref. NSF GB 41458.

Descriptors: *Algae, *Ammonium compounds, *Symbiosis, *Kinetics, *Reefs, Ammonium salts, Madracis mirabilis, Ammonia, Laboratory tests, Nutrients, Ecology, Coral, Nutrient requirements, Discovery Bay, Jamaica, Sea water.

Laboratory experiments of ammonium uptake by symbiotic and aposymbiotic Madracis mirabilis (coral reef) colonies show that uptake is affected by symbiotic algae (zooxanthellae). With symbiotic M. mirabilis, ammonium medium concentration decreases rapidly during the first 10-15 minutes and relatively more slowly thereafter, approaching ambient concentrations after 2-3 hr. Aposymbiotic M. mirabilis and spiked sea water controls also decrease the ammonium concentration, both at virtually identical rates, but at 1/6th the rate of synbiotic M. mirabilis. Faster uptake by isolated algae than by controls; however, uptake rates by isolated algae are also significantly lower than those for intact corals based on zooxanthellae numbers. Naturally-occurring aposymbiotic colonies of M. mirabilis were located in Discovery Bay, Jamaica, contiguous with larger colonies of normal synbiotic M. mirabilis coral. (Danovich-Wisconsin)
W80-04340

EFFECTIVENESS OF SUBMERSED ANGIOSPERM-EPIPHYTE COMPLEXES ON EXCHANGE OF NUTRIENTS AND ORGANIC CARBON IN LITTORAL SYSTEMS. III. REFRACTORY ORGANIC CARBON,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
For primary bibliographic entry see Field 5B.
W80-04348

GROWTH OF THE AQUATIC PLANT MYRIOPHYLLUM SPICATUM IN A LITTORAL AREA OF THE HUDSON RIVER ESTUARY,
EG and G Environmental Consultants, Waltham, MA.
C. A. Menzie.
Aquatic Botany, Vol 6, No 4, p 365-375, August 1979. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Myriophyllum spicatum, *Hudson River Estuary(NY), *Standing crops, *Seasonal, *Growth rates, Estuaries, Aquatic plants, Leaves, Biomass, Haverstraw Bay(NY), Algae, Ecology, Organic matter, Water temperature, Variability, Biological communities, Physical properties, Sediments, Substrates, New York.

Group 2I—Water In Plants

Eurasian milfoil (Myriophyllum spicatum) standing crops range from 0 g/sq m in winter to 60 g/sq m in summer in a cove within Bowline Pond, a small embayment of the Hudson River, New York measured January 1975-1976. M. spicatum main growth occurs May-December; peaks in dry weight biomass are observed in July (60 g/sq m) and October (32 g/sq m). Biomass decreases abruptly in August due to high temperatures (42C). Loss of plant biomass November-January represents winter die-off. Therefore, cove standing stocks exhibit major temporal variability. Low maximum standing crop (60 g/sq m) is due to physical conditions in the estuary; primary factors are probably light penetration (less than 1 m), tidal current regime (velocities up to 30 cm/s), and sediment type (sandy). M. spicatum annual productivity is 82 g/sq m. The proportion of leaf and stem biomass shifts throughout the year. Relative proportion of leaf biomass decreases May-July, corresponding to early M. spicatum growth. Following standing stock peak, the relative proportion of leaf biomass increases. Particulate matter on M. spicatum ranges from 0.8 g/g M. spicatum biomass (June mean) to 3.8 g/g M. spicatum (May mean). Particulate matter dry weight is generally greater than M. spicatum biomass; annual accumulation rate is 118 g/sq m. Large amounts of accumulated particulate matter in May are due to filamentous diatom Melosira. From June to August, Cladophora fracta, a filamentous green algae, comprises most of this material. (Danovich-Wisconsin)
W80-04349

INORGANIC MINERAL NUTRIENT LEVEL STUDIES ON POTAMOGETON PECTINATUS L. AND ENTEROMORPHA PROLIFERA IN FORFAR LOCH, SCOTLAND,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W80-04356

PHOSPHATE REQUIREMENT OF ANABAENA OSCILLARIOIDES AND ITS ECOLOGICAL IMPLICATIONS,
Auckland Univ. (New Zealand). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-04454

FACTORS CAUSING ELEVATED BIOLOGICAL OXYGEN DEMAND IN THE LITTORAL ZONE OF LAKE WINGRA, WISCONSIN,
Wisconsin Univ., Madison. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-04457

2J. Erosion and Sedimentation

CALCULATION OF THE TOTAL ANTHROPOGENIC LEAD IN THE SEDIMENTS OF A RURAL ONTARIO LAKE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-04210

KINETICS OF RED CLAY BLUFF DISSOLUTION IN WESTERN LAKE SUPERIOR,
Wisconsin Univ.-Superior.
D. A. Bahnick, T. P. Markee, and R. K. Roubal.
Journal of Great Lakes Research, Vol 5, No 2, p 221-224, 1979. 1 Fig, 12 Ref. EPA R005169-01.

Descriptors: *Erosion, *Bank erosion, *Silica, *Lake Superior, Dissolved solids, Clays, Particle size, Mineralogy, Sediments, Solutes, Chemicals, Lakes, Dissolution, Clay bluffs.

The dissolution of red clay bluff samples from the southwestern Lake Superior shoreline area in Lake Superior water or deionized water was studied by following the aqueous concentrations of reactive silica over a 3-month period. The dissolution process was initially rapid, followed by a first-order dissolution process (k = 9.4 x 10 to the minus 7th power/sec) up to about 30 days. After about 30 days, the rate of dissolution of the bluff material followed linear kinetics (k = 5.4 x 10 to the minus 8th power mg Si02/gram of bluff per second). (Sims-ISWS)
W80-04216

MINERALOGY AND DISTRIBUTION OF FINE-GRAINED SEDIMENTS IN LITTLE TRAVERSE BAY, LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
D. K. Rea, and J. D. Pigula.
Journal of Great Lakes Research, Vol 5, No 2, p 170-176, 1979. 9 Fig, 2 Tab, 13 Ref.

Descriptors: *Sediments, *Mineralogy, *Distribution patterns, *Bays, *Lake Michigan, Bottom sediments, Sediment transport, Particle size, Water circulation, Winds, Sampling, Data processing, Analysis, Quartz, Carbonates, Clays, Sedimentology, *Little Traverse Bay(MI), Feldspar.

Little Traverse Bay, northeastern Lake Michigan, contains sediments ranging in mean grain size from about 1.5 phi around the bay margins to 7 phi in the central portion. Mineralogy of the fine-grained fraction of these sediments show the four main mineral groups, quartz, feldspars, clays, and carbonates, to have decidedly different distributions within the bay. Quartz and feldspar reach maxima near the center of the bay, while carbonates are highest around the edge. Clay mineral abundance reaches three separate maxima in regions characterized by very poorly sorted sediment. There are two important sources of these sediments, extensive outcrops of Devonian limestones and dolomites along the south shore of the bay and bluffs of reddish glacial till along the northwestern shoreline. Materials from these areas are transported eastward to the bay head by longshore transport incurred by the prevailing westerly winds and then return westward along the deep central trough of the bay as the wind-induced setup is relieved. Essentially all the calcite and much of the dolomite entering Little Traverse Bay undergoes dissolution during transport resulting in the carbonate-poor sediments of the bay floor. (Sims-ISWS)
W80-04218

THE TRANSPORT AND OXYGEN DEMAND OF ORGANIC CARBON RELEASED TO RUNOFF FROM CROP RESIDUES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-04226

AVAILABILITY TO SCENEDESMUS QUADRICAUDA OF DIFFERENT FORMS OF PHOSPHORUS IN SEDIMENTARY MATERIALS FROM THE GREAT LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W80-04253

AGRICULTURAL SOURCES OF FLUVIAL SUSPENDED SEDIMENTS,
Guelph Univ. (Ontario). Ontario Inst. of Pedology.
G. J. Wall, W. T. Dickinson, and L. J. P. van Vliet.
Progress in Water Technology, Vol 11, No 6, p 481-499, 1979. 6 Fig, 4 Tab, 13 Ref.

Descriptors: *Erosion, *Sediments, *Sediment transport, *Agricultural-runoff, *Canada, Variability, Spatial distribution, Temporal distribution, Watersheds(Basins), Soils, Suspended solids, Dissolved solids, Precipitation(Atmospheric), Rainfall, Snowmelt, Mapping, Sedimentology.

A detailed study regarding areas that contribute sediment into the streams of two small agricultural watersheds in Canada has revealed that these areas may be expected to (1) constitute a relatively small percentage of the total watershed area, (2) be highly variable from season to season, year to year, and basin to basin, and (3) be in close proximity to streams. The sediment-contributing area during high basin moisture spring conditions is essentially equivalent to the runoff-contributing area. Areas contributing runoff during low moisture conditions in the spring and fall are considered to be potential rather than active sediment-producing areas. High sediment-producing areas are located close to stream channels, but the distribution and significance of sediment-producing categories and their location varies from basin to basin. Management strategies for controlling sediment production in agricultural areas should therefore be closely linked to a consideration of sediment source areas and their variability in time and space. (Sims-ISWS)
W80-04258

SOME BASIC CONCEPTS OF WAVE SEDIMENT TRANSPORT,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
P. Nielsen.
Series Paper No 20, 1979. 160 p, 61 Fig, 3 Tab, 99 Ref, 1 Append.

Descriptors: *Sediment transport, *Reviews, *Model studies, *Boundary processes, *Beds, Waves(Water), Analytical techniques, Sediment-water interfaces, Suspended solids, Sediments, Shape, Beds under water, Movement, Theoretical analysis, Mathematical models, Flow, Drag, Bed load, Suspension, Ripple marks, Oscillatory flow, Incipient motion.

The literature on the basic mechanisms of wave sediment transport was reviewed. New theoretical and empirical results were presented concerning the motion of suspended particles, the magnitude and distribution of suspended sediment concentrations, and the geometry of bed forms under waves. A predictive model for sediment transport under waves and weak currents was presented. An analysis of the model revealed that the weakest point of our present-day knowledge on wave sediment transport is the description of the steady flow components near the bottom. Experimental results obtained during the study were listed in the appendix. (Humphreys-ISWS)
W80-04304

ENERGY DISSIPATION DURING SUBGLACIAL ABRASION AT NISQUALLY GLACIER, WASHINGTON, U.S.A.,
Washington Univ., Seattle. Geophysics Program.
For primary bibliographic entry see Field 2C.
W80-04329

SEDIMENT CONCENTRATION IN MELT WATERS AS AN INDICATOR OF EROSION PROCESSES BENEATH AN ALPINE GLACIER,
Manchester Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-04330

2K. Chemical Processes

ACID PRECIPITATION IN THE WESTERN UNITED STATES,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
W. M. Lewis, Jr., and M. C. Grant.
Science, Vol 207, No 4427, p 176-177, January 11, 1980. 1 Fig, 11 Ref.

Descriptors: *Chemistry of precipitation, *Precipitation(Atmospheric), *Acidity, *Colorado, Sampling, Chemical analysis, Acids, Hydrogen ion concentration, Data processing, Water pollution, Water pollution sources, Air pollution, Path of pollutants, *Western U.S., *Acid precipitation, Trends.

Precipitation chemistry data from a rural area at an elevation of 2900 meters near the Continental Divide in Colorado showed unexpectedly low pH values for bulk precipitation. A significant downward trend in pH over the past 3 years is associated with increasing amounts of nitric acid in precipitation. (Sims-ISWS)

W80-04213

TRACE ELEMENTS IN MONSOON RAINS AT BOMBAY AND OVER THE ARABIAN SEA,
Bhabha Atomic Research Centre, Bombay (India).
S. Sadasivan.
Mausam, Vol 30, No 4, p 449-456, October 1979. 9 Fig, 3 Tab, 20 Ref.

Descriptors: *Rain water, *Trace elements, *Monsoons, Rainfall, Chemicals, Chemistry of precipitation, Precipitation(Atmospheric), Water chemistry, Pollutants, Sea water, Sodium, Chlorine, Bromine, Iodine, Manganese, Calcium, Magnesium, Potassium, Sampling, Data processing, Regression analysis, *India.

A large number of rainwater samples were collected at three locations in Bombay city and were analyzed for sodium, chlorine, bromine, iodine, manganese, calcium, magnesium, and potassium. A few rainwater samples were also collected on board a ship, over the Arabian Sea, and were analyzed. The results showed that the seasalt aerosols predominate the trace element composition of the rainwater. Effect of industrial pollution was localized. The average Cl/Na ratio for all samples was near the seawater ratio of 1.8 while Br and I showed, respectively, a small and a very large enrichment relative to Na from seawater. The results indicated that K is enriched in the transfer from seawater to air while Mg is not. Large Ca excesses were measured in the samples, and a need for a correct evaluation of the source of this excess Ca was indicated. (Sims-ISWS)
W80-04240

THE CHEMISTRY OF THE RIVER WYE,
University of Wales. Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W80-04248

BUFFERING OF SILICA AND PHOSPHATE IN A TURBID RIVER,
Maine Univ. at Orono, Walpole. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W80-04252

THE HYDROCHEMISTRY OF AN AQUIFER NETWORK,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Use Research.
B. G. Williams, and R. Evans.
Progress in Water Technology, Vol 11, No 6, p 361-367, 1979. 3 Fig, 3 Tab, 4 Ref.

Descriptors: *Water chemistry, *Groundwater, *Aquifers, *Australia, Geology, Hydrogeology, Sampling, Chemical analysis, Chemicals, Hydrogen ion concentration, Data processing, Analytical techniques, Classification, Watersheds(Basins), Hydrology, Chemistry.

A comparison was made between the interpretation of hydrochemical data from a network of shallow aquifers by conventional trilinear diagrams and a numerical classification technique. Neither method produced groupings that matched the nature and physical location of aquifers within the network, but Principal Coordinate Analysis appeared to have considerable potential for developing useful interpretations of subsurface water chemistry. (Sims-ISWS)
W80-04263

PHOSPHORUS IN A MODEL POND STUDY: I SEDIMENT SELECTION AND PREPARATION,
Science and Education Administration, Durant, OK. Water Quality Management Lab.
For primary bibliographic entry see Field 5C.
W80-04343

OCCURRENCE OF NITRIC AND NITROUS OXIDES IN A COASTAL MARINE SEDIMENT,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
J. Sorensen.
Applied and Environmental Microbiology, Vol 36, No 6, p 809-813, December 1978. 3 Fig, 18 Ref.

Descriptors: *Sediments, *Nitrogen cycle, *Denitrification, *Gases, *Cores, *Bacteria, Soil chemistry, Geochemistry, Nitrogen, Nitrogen compounds, Nitrites, Nitrates, Soil microorganisms, Depth, Aquatic animals, Burrows, Kysing Fjord(Denmark), Marine geology, Coasts, Oxidation-reduction potential, Reduction(Chemical), Denmark.

Chemical analysis suggests that bacterial denitrification is the source of nitric and nitrous oxides in sediment samples taken from Kysing Fjord, a shallow, brackish basin off Jutland, Denmark. Peak denitrification activity occurs 1-3 cm below the sediment surface and only a little activity occurs at low nitrate concentrations in the transition zone. Nitric and nitrous oxide accumulations are not associated with the main zone of denitrification activity; instead, the maximum is located at the lower edge of the activity profile. A secondary denitrification zone occurs in the deeper layers of cores which contain brown, oxidized patches in the black, sulfide-rich layers below the transition zone; these patches are apparently induced by macrofauna burrowing activity. Most cores contain sediment that is oxidized to 5 cm depth as judged from brown coloration and surface layer positive redox potentials. The transition zone towards deeper, reduced layers with negative redox potentials is usually 1-2 cm. Nitrate concentrations decline rapidly with depth, from maximum close to the sediment surface to low values at the transition zone. Nitric and nitrous oxide maxima are located at the transition zone. Nitrous oxide peak concentrations are always less than 5 micro M, whereas nitric oxide highest concentrations are 200 micro M. (Danovich-Wisconsin)
W80-04362

2L. Estuaries

NUTRIENT AND OXYGEN REDISTRIBUTION DURING A SPRING NEAP TIDAL CYCLE IN A TEMPERATURE ESTUARY,
Virginia Inst. of Marine Science, Gloucester Point; and College of William and Mary, Gloucester Point, VA. School of Marine Science.
K. L. Webb, and C. F. D'Elia.
Science, Vol 207, No 4434, p 983-985, February 29, 1980. 2 Fig, 1 Tab, 16 Ref. NSF OCE75-2041.

Descriptors: *Estuaries, *Nutrients, *Dissolved oxygen, *Tidal effects, Oxygen, Density, Nitrogen compounds, Nitrites, Ammonia, Phosphorus, Phosphorus compounds, Phosphates, Stratification, Water circulation, Tides, Tidal waters, Sampling, Data processing, Nitrogen.

Spring tidal currents produce homogeneous water columns in a number of estuaries that are moderately stratified during neap tides. In the York River estuary, this destratification redistributes ammonium and phosphate regenerated by the benthos as well as oxygen from the surface. This redistribution has significant implications for nutrient cycles, organism distributions, and the management of estuaries. (Sims-ISWS)
W80-04212

EFFECTS OF CONTINUOUS CHLORINATION ON ENTRAINED ESTUARINE PLANKTON,
Environmental Protection Agency, Johns Island, SC.
S. J. Erickson, and H. R. Foulk.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 44-47, January 1980. 1 Tab, 13 Ref.

Descriptors: *Chlorination, *Estuaries, *Plankton, Sea water, Chlorine, Effects, Water temperature, Salinity, Biomass, Algae, Laboratory tests, Phosphates, Analytical techniques, Chlorination effects, Adenosine triphosphate.

The effects of continuous chlorination on planktonic life as measured by adenosine triphosphate content were examined in two running seawater aquaria systems for 1 year. The first system had ninety-six 37-liter aquaria; the second system had forty 5.5-liter aquaria. Salinity was 20.9 to 28.7%; water temperature, 10.1 to 30.8C; pH, 8.0 + or - 0.2. In the first system, the mean control adenosine triphosphate concentration was 0.55 microgram/liter. In aquaria treated with sodium hypochlorite, 0.125 mg/liter reduced the adenosine triphosphate to 87.1% of mean control concentration; 0.25 mg/liter, to 77.6%; and 0.5 mg/liter, to 66.8%. In the second system, the mean control adenosine triphosphate concentration was 0.40 microgram/liter. In aquaria treated with sodium hypochlorite, 0.47 mg/liter reduced adenosine triphosphate to 74.5% of the mean control concentration; 0.94 mg/liter, to 56.7%; and 1.41, to 42.5%. (Sims-ISWS)
W80-04220

THE RELATION BETWEEN PORE WATER CHEMISTRY AND BENTHIC FLUXES OF NUTRIENTS AND MANGANESE IN NARRAGANSETT BAY, RHODE ISLAND,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
R. J. McCaffrey, A. C. Myers, E. Davey, G. Morrison, and M. Bender.
Limnology and Oceanography, Vol 25, No 1, p 31-44, January 1980. 6 Fig, 4 Tab, 20 Ref.

Descriptors: *Pore water, *Nutrients, *Manganese, *Benthos, *Bottom sediments, *Rhode Island, Water chemistry, Advection, Sediment-water interfaces, Benthic fauna, Diffusion, Depth, Cores, Carbon cycle, Organic matter, *Narragansett Bay(RI).

Benthic fluxes of dissolved nutrients and manganese from biologically disturbed, relatively unpolluted sediment in Narragansett Bay, Rhode Island, have been measured. Analysis of the vertical gradients of chemical species dissolved in pore waters and the uptake of 22Na from the overlying water permit evaluation of the contribution of biological advection and molecular diffusion to the transport of dissolved material across the sediment-water interface. The activity of bottom-dwelling organisms appears to be about as important as molecular diffusion in most cases. The sum of the independently estimated contributions by both mechanisms is in good agreement with integrated benthic fluxes measured in situ. Sulfate and oxygen oxidize comparable amounts of organic matter in these sediments. (Visocky-ISWS)
W80-04251

A STUDY OF THE ROLE OF THE SEAGRASS POSIDONIA AUSTRALIS IN THE CARBON BUDGET OF AN ESTUARY,
Commonwealth Scientific and Industrial Research Organization, North Beach (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5C.
W80-04278

A NEW TECHNIQUE FOR MEASURING TIDAL CURRENTS BY USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
For primary bibliographic entry see Field 7B.
W80-04307

GROWTH OF THE AQUATIC PLANT MYRIOPHYLLUM SPICATUM IN A LITTORAL AREA OF THE HUDSON RIVER ESTUARY,
EG and G Environmental Consultants, Waltham, MA.
For primary bibliographic entry see Field 2I.
W80-04349

SALINITY INFLUENCE ON THE ECOLOGY OF PHYTOFLAGELLATE BLOOMS IN LOWER NEW YORK BAY AND ADJACENT WATERS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5C.

W80-04351

THE FLAX POND ECOSYSTEM STUDY: EXCHANGES OF INORGANIC NITROGEN BETWEEN AN ESTUARINE MARSH AND LONG ISLAND SOUND,
Marine Biological Lab., Woods Hole, MA.
G. M. Woodwell, C. A. S. Hall, D. E. Whitney, and R. A. Houghton.
Ecology, Vol 60, No 4, p 695-702, August 1979. 2 Fig, 1 Tab, 41 Ref. NSF AG-375.

Descriptors: *Estuarine environments, *Flax Pond(NY), *Cycling nutrients, *Long Island Sound(NY), *Nitrogen, Estuaries, Seasonal, Nitrogen compounds, Nitrites, Nitrates, Ammonia, Inorganic compounds, Anion exchange, Cation exchange, Coastal marshes, Salt marshes, Tides, Tidal effects, Nutrient budgets, Nutrient transport, Phytoplankton, New York.

From September 1972 to April 1974 water samples were collected from Flax Pond, an estuarine marsh on the north shore of Long Island, New York; the exchange of nitrogen between the marsh and Long Island Sound varied seasonally in response to several factors. The greatest variation occurs in nitrate; concentrations range 1.3-230 microg N/l. Nitrogen as ammonium ion occurs at concentrations 6-106 microg N/l; and nitrite in concentrations of 30-310 microg N/l. All three ions follow seasonal patterns that are similiar: highest concentrations are in winter, lowest are in spring during phytoplankton blooms. The largest gross movements of inorganic nitrogen occur during winter when concentrations are high and when up to 85 kg of nitrate-nitrogen are exchanged between Flax Pond and Long Island Sound on each tide. The largest net exchange occurs in late summer-early fall as ammonium is lost from Flax Pond to Long Island Sound. However, the annual net exchange of inorganic nitrogen does not differ significantly from zero since inorganic nitrogen lost in summer through outward exchange with Long Island Sound is replaced in winter through inward exchange. Crude estimations of the total inorganic nitrogen budget of Long Island Sound suggest that estuaries, precipitation, and rivers each contribute approximately equal inputs. (Harris-Wisconsin)
W80-04389

THE ROLE OF ZOOPLANKTON IN THE NITROGEN DYNAMICS OF A SHALLOW ESTUARY,
Duke Univ., Beaufort, NC. Marine Lab.
For primary bibliographic entry see Field 5C.
W80-04448

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3C. Use Of Water Of Impaired Quality

POLIOVIRUS MOVEMENT DURING HIGH RATE LAND FILTRATION OF SEWAGE WATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W80-04245

THE EFFECTS OF IRRIGATION WITH MEATWORKS-FELLMONGERY EFFLUENT ON WATER QUALITY IN THE UNSATURATED ZONE AND SHALLOW AQUIFER,
Canterbury Frozen Meat Co. Ltd. Christchurch (New Zealand).
G. M. Keeley, and B. F. Quin.
Progress in Water Technology, Vol 11, No 6, p 369-386, 1979. 6 Fig, 7 Tab, 23 Ref.

Descriptors: *Irrigation, *Waste water disposal, *Groundwater, Pollutants, Nitrates, Nutrients, Bacteria, Sampling, Path of pollutants, Pastures, Grazing, Drainage, Effluents, Soils, Soil water, Soil contamination, Water quality, *Meatworks-fellmongery wastes.

Land application of meatworks-fellmongery effluent has been carried out at Fairton in Canterbury (New Zealand) for 80 years. Approximately 900 mm of effluent is applied annually to 100 ha of shallow soil (overlying gravels), which is bordered for surface irrigation, sown in pasture, and used for fattening beef. Because of the high nutrient content of the effluent, much of which is attributable to the fellmongery operation, soil fertility has quickly been increased to the point where the majority of most nutrients (phosphorus being a notable exception) are lost in the drainage. Investigation showed that the chemical composition of the drainage became more homogeneous with depth. The drainage (which also totaled 900 mm annually) and effluent contained similar concentrations of the species relatively unaffected by soil processes (Cl, Na, and S04-S), but the 100 mg/liter of N in the effluent, most of which was present as NH4-N, was replaced by N03-N in the drainage, although the lower concentration (40 mg/liter) suggested that denitrification losses were considerable. Despite the shallow nature of the soil, bacterial numbers in the gravel substrata were much lower than in the topsoil. The chemical composition of the groundwater beneath the scheme, where the water table is 21 m below ground level, was similar to that of drainage collected from a depth of 6 m. A three-depth investigation well situated 500 m from the scheme in the direction of groundwater flow showed definite chemical and bacteriological contamination from the effluent irrigation scheme only in the shallowest of the three depths. (Sims-ISWS)
W80-04262

AN INTERNATIONAL COMPARISON OF TRENDS IN WATER RESOURCES MANAGEMENT,
Fordham Univ., Bronx, NY. School of Law.
For primary bibliographic entry see Field 6E.
W80-04498

3D. Conservation In Domestic and Municipal Use

AN INTERNATIONAL COMPARISON OF TRENDS IN WATER RESOURCES MANAGEMENT,
Fordham Univ., Bronx, NY. School of Law.
For primary bibliographic entry see Field 6E.
W80-04498

3F. Conservation In Agriculture

SUITABILITY OF REGION-WIDE IRRIGATION SCHEDULING BY LOCAL EVAPOTRANSPIRATION MEASUREMENT,
Nebraska Univ. Panhandle Station at Scottsbluff.
For primary bibliographic entry see Field 2D.
W80-04442

THE IRRIGATION REVOLUTION AND ITS ENVIRONMENTAL CONSEQUENCES,
For primary bibliographic entry see Field 6E.
W80-04490

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

URBAN STORMWATER MANAGEMENT, PROCEEDINGS OF A SOUTHEAST REGIONAL CONFERENCE, NORTH CAROLINA STATE UNIVERSITY, APRIL 10-11, 1979.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164627, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. (1980) edited by Howells, D. H. 258 p. OWRT B-123-NC(6), 14-34-0001-9144.

Descriptors: *Storm water, *Urban runoff, *Storm runoff, *Urbanization, Water management(Applied), Erosion control, Drainage programs, Water control, Sedimentation, Flood plain zoning, Conferences, Documentation, Southeast U.S.

Proceedings of an invitational conference to identify and prioritize water resource problems and to define research and technology transfer needs for the Southeastern United States are presented. Water resources research institutes and water resource agencies in the following states were involved: Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. The theme of the conference was urban stormwater management with emphasis on drainage and detention, flood plain management, erosion and sedimentation control, and stormwater pollution control. The strengths and deficiencies of State and local urban stormwater management programs were examined and necessary steps to correct these weaknesses were discussed. Following the State, local, and regional program discussion two other papers were given: 'A Western Experience in Stormwater Management' and 'National Water Policy and Urban Stormwater Management'. Also given in the proceedings is a 'Model Surface Water Runoff Control Ordinance' for Florida. A list of conference participants is included. (Seigler-IPA)
W80-04201

LAND CAPABILITY FOR SURFACE WATER PRODUCTION,
Soil Conservation Authority of Victoria, Kew (Australia).
P. N. King.
Progress in Water Technology, Vol 11, No 6, p 501-520, 1979. 1 Fig, 13 Tab, 2 Ref.

Descriptors: *Land use, *Water quality, *Water yield, *Model studies, Mathematical models, Pollutants, Pathogenic bacteria, Phosphates, Nitrates, Pesticides, Oil, Heavy metals, Sediments, Heat, Water resources, Water supply, Watersheds(Basins), Agriculture, Domestic water, Surface waters.

This paper presented a summary of a Masters of Environmental Science thesis which developed two conceptual models predicting the effect of a combination of land features, land use, and land management on water quality and yield, and how the end use of water and its treatment would affect the suitability for use. Limited testing of the water yield submodel demonstrated how the models may be optimized. Both models may be combined for optimization of total water management strategies. (Sims-ISWS)
W80-04257

CHANGES IN PHOSPHORUS CONCENTRATION IN A EUTROPHIC LAKE AS A RESULT OF MACROPHYTE-KILL FOLLOWING HERBICIDE APPLICATION,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
For primary bibliographic entry see Field 5C.
W80-04276

HYDROLOGIC CONDITIONS IN BROWARD COUNTY, FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04378

THE PROTECTION OF HYDROLOGIC AND LAND PRESERVATION VALUES UNDER THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977: A WELCOME REFORM,

Appalachian Research and Defense Fund, Inc., Charleston, WV.
For primary bibliographic entry see Field 6E.
W80-04471

DEMORALIZED WETLANDS OWNERS: IS THERE JUST COMPENSATION AFTER BRECCIAROLI V. CONNECTICUT COMMISSIONER OF ENVIRONMENTAL PROTECTION.,
For primary bibliographic entry see Field 6E.
W80-04488

4B. Groundwater Management

POLIOVIRUS MOVEMENT DURING HIGH RATE LAND FILTRATION OF SEWAGE WATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W80-04245

EVALUATION OF METHODS FOR ESTIMATING GROUND-WATER WITHDRAWALS IN WESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. H. Baker, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175631, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-92, 1979. 70 p, 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Methodology, *Estimating, *Groundwater mining, *Withdrawals, *Kansas, Aquifers, Analytical techniques, Sampling, Pumping, Water utilization, Irrigation, Crops, Evaluation, *Western Kansas.

Individual users report ground-water withdrawals annually to the Kansas State Board of Agriculture. It is estimated that these values are 10 to 15 percent higher than actual values because most users do not possess the means for accurately determining discharge rates. Methods of estimating groundwater use in western Kansas that appear to offer the desired accuracy include (1) extrapolation from a sample of metered withdrawals, (2) calculation from precipitation and irrigated acreages of various crop types, and (3) calculation from a sample of power-coefficients. All three methods are being tested and compared with actual measured values. Newly developed electronic running-time and discharge-totaling meters are being tested that may give accurate values of total pumping time and discharge at small cost. (Kosco-USGS)
W80-04370

WATER RESOURCES OF THE SANTA ROSA INDIAN RESERVATION AND VICINITY, RIVERSIDE COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
A. Buono, W. R. Moyle, Jr., and P. Dana.
Available from: OFSS/USGS Box 25425, Fed. Ctr. Denver, CO, Paper copy $4.50 Microfiche $3.50. Geological Survey open-file report 79-1172, September 1979. 32 p, 8 Fig, 3 Tab, 27 Ref.

Descriptors: *Groundwater resources, *Indian reservations, *California, *Surface waters, *Water quality, Chemical analysis, Sampling, Sites, Drilling, Test wells, Potential water supply, Aquifer characteristics, Geology, Data collections, Measurement, Water levels, Streamflow, Precipitation(Atmospheric), Runoff, Evapotranspiration, *Santa Rosa Indian Reservation(Calif).

Additional water for irrigation is needed by the Santa Rosa Indian Reservation, Riverside County, California. Water in the area is derived from precipitation, which averages 12 inches annually, on three subbasins nearly surrounding the 17-square-mile reservation. No ground water flows in from outside the area. A supply well that taps sandy material overlying the pre-Tertiary basement complex showed a specific capacity of 0.4 gallon per minute per foot of drawdown. Estimates of specific yield for material encountered during drilling of three wells and a test hole ranged from 5 to 10 percent. A gravity survey outlined the thickest section of the aquifer in the Vandeventer Flat area, and test wells are proposed to determine its potential well yield. Damming streams to retain runoff (about 1,500 acre-feet per year, and more during periods of heavy precipitation) is also proposed. Analyses of water from the supply well and five major springs showed that ground water is suitable for irrigation except at Sulphur Spring, where the percent sodium of 97 exceeds recommended maximums, and at Bull Canyon Spring, where the specific conductance of 1,300 micromhos indicate a salinity hazard. (Kosco-USGS)
W80-04376

RESULTS OF TRANSIENT SIMULATIONS OF A DIGITAL MODEL OF THE ARIKAREE AQUIFER NEAR WHEATLAND, SOUTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. T. Hoxie.
Available from: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $2.00, Microfiche $3.50. Geological Survey open-file report 79-1280, 1979. 17 p, 7 Fig, 3 Tab, 4 Ref.

Descriptors: Model studies, *Simulation analysis, *Aquifer characteristics, *Wyoming, Projections, Computer models, Hydrogeology, Groundwater resources, Pumping, Industrial water, Irrigation wells, Water levels, Drawdown, *Arikaree aquifer(Wyo), *Southeastern Wyoming.

Revised ground-water pumpage data have been imposed on a ground-water flow model previously developed for the Arikaree aquifer in a 400 square-mile area in central Platte County, Wyo. Maximum permitted annual ground-water withdrawals of 750 acre-feet for industrial use were combined with three irrigation-pumping scenarios to predict the long-term effects on ground-water levels and streamflows. Total annual ground-water withdrawals of 8,806 acre-feet, 8,033 acre-feet, and 5,045 acre-feet were predicted to produce average water-level declines of 5 feet or more over areas of 99, 96, and 68 square miles, respectively, at the end of a 40-year simulation period. The first two pumping scenarios were predicted to produce average drawdowns of more than 50 feet over areas of 1.5 and 0.8 square miles, respectively, while the third scenario resulted in average drawdowns of less than 50 feet throughout the study area. In addition, these three pumping scenarios were predicted to cause streamflow reductions of 2.6, 2.0, and 1.4 cubic feet per second, respectively, in the Laramie River and 4.9, 4.7, and 3.7 cubic feet per second, respectively, in the North Laramie River at the end of the 40-year simulation period. (Kosco-USGS)
W80-04379

HYDROLOGIC AND GEOLOGIC DATA FROM THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-04381

HYDROLOGIC AND RELATED DATA FOR WATER-SUPPLY PLANNING IN AN INTENSIVE-STUDY AREA, NORTHEASTERN WICHITA COUNTY, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. Kume, L. E. Dunlap, E. D. Gutentag, and J. G. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-145891, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-105, 1979. 51 p, 4 Fig, 13 Tab, 7 Ref.

Descriptors: *Hydrologic data, *Water supply, *Planning, *Kansas, *Hydrogeology, Data collections, Groundwater, Water wells, Water levels, Water yield, Chemical analysis, Sites, Climatic data, Observation wells, Rainfall, Soil moisture, Crop production, Solar radiation, Aquifers, Drawdown, Pumping, Irrigation wells, Water conservation, Irrigation, Water management(Applied), *Wichita County(Kans).

Data are presented that result from an intensive geohydrologic study for water-supply planning in a 12-square-mile area in northeastern Wichita County, Kansas. These data include records of wells, test drilling, chemical analyses, groundwater levels, rainfall, soil moisture, well yield, solar radiation, crop yield, and crop acreage. Data indicate that water levels in the unconsolidated aquifer are declining at an average annual rate of about 1 to 2 feet per year (1950-78). This decline is the aquifer's response to pumping by irrigation wells for watering corn, wheat, grain sorghum, and other crops. (Kosco-USGS)
W80-04385

CONJUNCTIVE WATER USE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Yevjevich.
Water International, Vol 4, No 3, p 17-24,30, September, 1979. 4 Fig.

Descriptors: *Conjunctive use, *Water management(Applied), *Water sources, Multi-purpose projects, History, Social impact, Economic justification, Legal aspects, Environmental effects, Political constraints, Computer models, Decision making, Optimization, Properties, Estimating, Systems analysis, Optimum development plans, Project planning, Water resources development, Water utilization, Water quality, Research priorities, Alternative water use.

The historical development of water resources planning and management over the last 100-150 years is reviewed. The present state-of-the-art is conjunctive use in the form of multi-structure, multi-purpose, and multi-source water resources systems. Basic concepts and dimensions of conjunctive water use are discussed with emphasis on integration of the water resources systems into the economic, social, environmental, legal, and political systems. Before a multi-source conjunctive use model can be developed, the following must be established: (1) commonalities and specificities of properties of various combinations of water sources; (2) basic, theoretically and experimentally verifiable, approaches to decomposition and recomposition of complex water resources systems; and (3) identification of subsystem properties, input, states and output processes. Optimization of decision making may follow general operational rules and equations, or a continual, real time approach. Several examples of conjunctive water use schemes are presented. These schemes depend on: (1) the number and position of water sources in relation to the user(s); (2) whether water(s) should be shifted between sources for any beneficial purpose; (3) whether water will flow through a conveyance structure uni-directionally or bi-directionally; and (4) topographical and economic constraints. Three avenues of research in conjunctive water use technology and the role of water quality are discussed. (Purdin-NWWA)
W80-04429

GROUND WATER MANAGEMENT IN GEORGIA,
Georgia Univ., Athens. Legislative Research Div.
J. E. Kundell.
Ground Water, Vol 18, No 1, p 77-79, January-February, 1980. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Ground water, *Water management(Applied), *Georgia, Water utilization, Withdrawal, Overdraft, Industrial plants, Surface water, Urbanization, Irrigation programs, Geomorphology, Land use, Geology, Water allocation(Policy), Water permits, State governments, Agriculture, Water rights.

Water quantity, rather than quality, is becoming increasingly important, not only in arid western states but also in humid eastern states like Georgia

which receives about 50 inches of precipitation annually. The Coastal Plain Province is the only area in Georgia underlain by extensive aquifers and is used for agriculture, forestry and recreation. Other areas depend primarily on surface water and are mainly urban/industrial. Industries are the major users of ground water but between 1970 and 1977 withdrawals have decreased by about 9% due to conservation measures and the use of more surface water. Rapid growth in agricultural irrigation has resulted in withdrawals increasing from 11% in 1970 to 18% of the total ground water use by 1977. Since 74% of the irrigation occurs in the southwestern portion of the State, historic lows were recorded in aquifers in the area during November, 1978. Irrigation withdrawals were exempted from the permit requirements of the 1972 Ground Water Use Act. This has led to an inability to manage the resource and questions regarding legal rights to the use of water. Measures may be taken during the 1980 session of the Georgia General Assembly to enable better management of the State's water resources. (Purdin-NWWA)
W80-04463

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF INCREASED LAND-USE UPON FRESHWATERS IN THE CENTRAL HIMALAYAS,
Kumaun Univ., Naini Tal (India). MAB/DST Lakes Project.
For primary bibliographic entry see Field 2E.
W80-04312

ENVIRONMENTAL PROTECTION MOTIVATION IN COASTAL ZONE LAND-USE LEGISLATION,
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04495

4D. Watershed Protection

POTENTIAL POLLUTANTS FROM AGRICULTURE--AN ASSESSMENT OF THE PROBLEM AND POSSIBLE CONTROL APPROACHES,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W80-04228

APPLICATION OF GEOMORPHIC PRINCIPLES TO ENVIRONMENTAL MANAGEMENT IN SEMIARID REGIONS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
S. A. Schumm, M. T. Bradley, and Z. B. Begin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169303, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Completion Report No 93, February 1980. 43 p, 15 Fig, 27 Ref. OWRT B-150-COLO (2), 14-34-0001-7143.

Descriptors: *Erosion, *Geomorphology, *Terrain analysis, *Semiarid climates, Land management, Evaluation, Soil stability, Vegetation, Accelerated erosion, Gully erosion, Valleys, *Erosion control.

In many valleys of the semiarid West valley floors are either flat and vegetated without a channel, or they are gullied. Using previously collected data from the Piceance Creek area of western Colorado, it is possible to identify a valley-slope threshold above which, for a given drainage area, gullying is probable. Below this valley-slope threshold the valley floors are stable; above it they are susceptible to gullying. When the relations and techniques developed in western Colorado were applied to the Chalk Bluffs area of northeastern Colorado, it was determined that valley width was also a significant factor determining valley stability, and a ratio of valley slope to valley width could be used to identify at a given drainage area a threshold zone of valley floor instability. These relations explain the observed variability of gullies and also permit identification of those locations where gullying is probable.
W80-04443

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

CALCULATION OF THE TOTAL ANTHROPOGENIC LEAD IN THE SEDIMENTS OF A RURAL ONTARIO LAKE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-04210

ORGANIC CONTAMINANT BEHAVIOR DURING GROUNDWATER RECHARGE,
Stanford Univ., CA.
P. V. Roberts, P. L. McCarty, M. Reinhard, and J. Schreiner.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 161-172, January 1980. 8 Fig, 2 Tab, 14 Ref. EPA R-804431.

Descriptors: *Groundwater recharge, *Recharge wells, *Injection wells, *Pollutants, *Organic compounds, Path of pollutants, Water pollution, Groundwater, Recharge, Chemicals, Reclaimed water, Waste water(Pollution), On-site investigations, Observation wells, Chemical analysis, Analytical techniques, Pollutant identification.

Concentration changes of organic trace contaminants were measured in an aquifer that was being recharged by direct injection of reclaimed water. The reclaimed water was obtained by advanced treatment of secondary effluent, including lime addition, coagulation, and sedimentation; air stripping; recarbonation; ozonation; and sand filtration. Naphthalene showed evidence of biodegradation in the aquifer. The field retention capacity of chlorobenzene was approximately 0.32 g/cu m aquifer in equilibrium with a concentration of 4 micrograms/liter in the water. The ratio of chlorobenzene transport relative to water movement was approximately one thirty-sixth. Chloroform was transported more rapidly than chlorobenzene, approximately one-fifth as fast as water. The approach showed promise for predicting water quality behavior in a large-scale groundwater recharge project based on short-term observations near the injection well. Concentrations were in the range of 0.1 to 10 micrograms/liter. (Sims-ISWS)
W80-04219

RURAL NONPOINT SOURCE WATER QUALITY IN A SOUTHEASTERN WATERSHED,
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 5B.
W80-04221

THE TRANSPORT AND OXYGEN DEMAND OF ORGANIC CARBON RELEASED TO RUNOFF FROM CROP RESIDUES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-04226

POTENTIAL POLLUTANTS FROM AGRICULTURE--AN ASSESSMENT OF THE PROBLEM AND POSSIBLE CONTROL APPROACHES,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W80-04228

STUDIES ON THE CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF SOIL-FILTERED DAIRY-SHED EFFLUENT,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 5B.
W80-04229

FEASIBILITY OF WATER QUALITY IMPROVEMENT IN THREE ILLINOIS RIVERS,
Arizona Univ., Tucson. Dept. of Landscape Architecture.
For primary bibliographic entry see Field 5B.
W80-04246

CLOSTRIDIUM PERFRINGENS AS A WATER POLLUTION INDICATOR,
Health Effects Research Lab., West Kingston, RI.
For primary bibliographic entry see Field 5B.
W80-04247

THE EFFECTS OF LAND USE AND HYDROLOGY ON GROUNDWATER QUALITY IN MID-CANTERBURY, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Ashburton (New Zealand). Winchmore Irrigation Research Station.
B. F. Quin, and R. J. Burden.
Progress in Water Technology, Vol 11, No 6, p 433-448, 1979. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *Land use, *Hydrology, *Groundwater, *Water quality, Irrigation, Agriculture, Pastures, Grazing, Sampling, Water chemistry, Nitrogen compounds, Nitrates, Chlorine, Nutrients, Pollutants, Geology, Recharge, Water pollution, *New Zealand.

Groundwater quality in Mid-Canterbury, New Zealand, between the Rakaia and Ashburton rivers (an area of 300,000 ha) can be classified into three distinct zones based on land use and hydrology. Zone A contains 0-3.5 g/cu m N03-N and 0-5 g/cu m Cl and consists primarily of runoff from the foothills and seepage from the rivers. Zone B, which contains 6-12 g/cu m N03-N and 5-10 g/cu m Cl, is situated beneath and downstream of a 26,000-ha surface irrigation scheme and consists primarily of drainage from this scheme. Zone C contains 5-20 g/cu m N03-N and 10-30 g/cu m Cl and lies beneath nonirrigated land that is not adjacent to major river recharge areas. The groundwater in this zone consists of varying proportions of drainage from surface-irrigated, spray-irrigated, and nonirrigated land, and seepage from the rivers. Future trends in groundwater quality were discussed in the light of these results. (Sims-ISWS)
W80-04261

NITRATE AND CHLORIDE IN GROUNDWATER, SURFACE WATER AND DEEP SOIL PROFILES OF CENTRAL CANTERBURY, NEW ZEALAND,
Lincoln Coll., (New Zealand). Dept. of Soil Science.
J. A. Adams, A. S. Campbell, W. R. McKeegan, R. J. McPherson, and P. J. Tonkin.
Progress in Water Technology, Vol 11, No 6, p 351-360, 1979. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Nitrates, *Groundwater, *Surface waters, Chlorides, Agricultural runoff, Water wells, Aquifers, Sampling, Chemical analysis, Nitrogen, Nitrogen compounds, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Water quality, *New Zealand, Trends.

Nitrate-N levels were found to be high in household groundwater wells and surface waters in the Lincoln area of Central Canterbury, New Zealand. A majority of Lincoln wells contained more than the limit for public water supplies of 10.2 mg/dm of nitrate-N recommended by the World Health Organization, whereas the majority of groundwater wells in other areas of Central Canterbury contained less than 5 mg/dm. A similar pattern occurred in surface waters, although nitrate-N levels were always lower than in groundwater. Nitrate-N levels decreased with well depth and fell to less than 1 mg/dm in wells tapping the deep (more than 35 m) confined artesian aquifer. Temporal variation in nitrate-N levels was investigated by weekly sampling of 12 Lincoln household

groundwater wells and 2 stream sampling sites in Lincoln. Nitrate-N levels were variable but rose significantly over the year with levels being highest and the rate of increase being greatest on the western side of Lincoln. The reason for the rapid increase in nitrate-N levels is unknown. Baseline stream nitrate-N levels were low but were considerably affected by groundwater inflows and point pollution sources. Chloride levels in groundwater and surface water were closely correlated with nitrate-N levels. Nitrate-N levels in the soil solution under more freely drained agricultural soils near Lincoln were similar to those observed in groundwater, suggesting that agriculture may be making a contribution to the nitrate-N load of groundwater in the study area. This is despite the fact that nitrogenous fertilizers are not widely used. On poorly drained soils, no evidence of vertical movement of nitrate was observed. (Sims-ISWS)
W80-04264

NITRATE REMOVAL FROM STREAMS DRAINING EXPERIMENTAL CATCHMENTS,
Ministry of Works and Development, Hamilton (New Zealand). Hamilton Science Centre.
For primary bibliographic entry see Field 5B.
W80-04265

NUTRIENT CONCENTRATIONS IN RUN-OFF FROM A GLEY PODZOL SOIL,
Canterbury University, Christchurch (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W80-04267

LOSSES OF PHOSPHORUS AND NITROGEN FORMS IN SUBSURFACE DRAINAGE WATER AS INFLUENCED BY PHOSPHATE FERTILIZER, GRAZING ANIMALS, AND IRRIGATION TREATMENTS,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-04268

FACTORS AFFECTING DOWNSLOPE MOVEMENT OF NUTRIENTS IN HILL PASTURE,
Department of Scientific and Industrial Reseach, Lower Hutt (New Zealand). Soil Bureau.
For primary bibliographic entry see Field 5B.
W80-04269

EFFECTS OF RURAL AND URBAN SOURCES OF PHOSPHORUS OF LAKE BURLEY GRIFFIN,
Canberra Coll. of Advanced Education (Australia). School of Applied Science.
For primary bibliographic entry see Field 5B.
W80-04270

SPRAY IRRIGATION OF DAIRY FACTORY WASTEWATER ONTO PASTURE--A CASE STUDY,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-04271

QUALITY OF DRAINAGE WATER FROM PASTURE TREATED WITH DAIRY SHED EFFLUENT,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-04272

DIURNAL OXYGEN RHYTHM AND PRIMARY PRODUCTION IN THE MIXED LAYER OF THE ATLANTIC OCEAN AT 20 DEGREES N,
Nederlands Inst. voor Onderzoek der Zee, Texel.
S. B. Tijssen.
Netherlands Journal of Sea Research, Vol 13, No 1, p 79-84, October 1979. 2 Fig, 10 Ref.

Descriptors: *Dissolved oxygen, *Analytical techniques, *Primary productivity, *Atlantic Ocean, *Estimating, Volumetric analysis, Diurnal, Variability, Mixing, Surface waters, Oxygen, Measurement, Chemical analysis, Testing procedures, Water chemistry, On-site investigations, On-site laboratories, Tracers.

Oxygen concentrations varied 415-426 microg at/cu dm November-December 1978 in Atlantic Ocean mixed layers; these high values provide substantial evidence that past C14 primary production estimates for the oceans are severe underestimates. Past calculations of diurnal oxygen variation in oceanic mixed layers estimated that primary production was 150-250 mg C/sq m d. Measurements were based on a maximum diurnal oxygen variation of 0.5-1 microg at/cu dm, indicating 0.1-0.2% variation in oxygen solubility at ambient salinity and temperature conditions. Measuring such small differences is beyond the precision of standard Winkler methods. For these experiments a phototritrator was built with a high precision endpoint determination, giving 0.05-0.1% standard error. Diurnal oxygen rhythms with amplitudes $<0.6\%$ ambient oxygen concentrations occur at five stations in the mixed layer of the Atlantic Ocean at 20 degrees N. Oxygen concentrations per cast within the mixed layer at different depth levels are remarkably constant. Mean standard deviation within the mixed layer at one station is only 0.29 microg at/cu dm. High concentrations are occasionally found in the upper 10 m. Evening oxygen concentrations are consistently and significantly higher than morning concentrations, allowing for light period increase and dark period decrease. Spatial and between-days variability never exceeds the difference between the night values and the mean of both morning casts. Estimated gross primary production in the mixed layer is high and averages 800 mg C/sq m d. (Danovich-Wisconsin)
W80-04282

CURRENT C14 METHODS FOR MEASURING PRIMARY PRODUCTION: GROSS UNDERESTIMATES IN OCEANIC WATERS,
Nederlands Inst. voor Onderzoek der Zee, Texel.
W. W. C. Gieskes, G. W. Kraay, and M. A. Baars.
Netherlands Journal of Sea Research, Vol 13, No 1, p 58-78, October 1979. 4 Fig, 7 Tab, 48 Ref.

Descriptors: *Tracers, *Primary productivity, *Analytical techniques, *Atlantic Ocean, *Estimating, Phytoplankton, Oceans, Chlorophyll, Algae, Surface waters, Sampling, Size, Volume, Mortality, Plankton, Organic matter, Euphotic zone, Fluorometry, Spectrophotometry.

Primary production measurements were made in situ in the North Equatorial Current, Atlantic Ocean November-December 1978; amounts of organic matter produced through autotrophic processes in tropical open ocean euphotic zones is 5-15 times higher than values derived from common C14 methods. The new estimates are based on measurements of C14 incorporation in organic matter of ocean samples incubated in 4 liter bottles; primary production estimates vary 100-750 mg C/sq m d. Incubation in smaller bottles causes abnormally high photochemical pigment destruction, presumably due to enhanced algal mortality. Detrimental enclosure effects are most serious in samples contained in 30 ml bottles for 12 hrs; effects are not significant in samples larger than 4 liters. Mortality in bottles may be caused directly by contact with glass walls, or indirectly because organic matter production and consumption in oligotrophic waters is easily upset when samples are enclosed. In uppermost euphotic layers, primary production is further underestimated because chlorophyll in algal cells incubated at a fixed depth bleaches more rapidly than chlorophyll in cells freely circulating in vertically mixed surface layers. Oceanic phytoplankton have high growth rates, with generation times in hours, not days. High heterotrophic activity takes place in conjuction with high organic matter primary production. Therefore, existing concepts of open ocean carbon cycling and solar energy conversion efficiencies need to be completely reconsidered since they have always been based on extremely low primary production values. (Danovich-Wisconsin)
W80-04284

EVALUATION OF PROTOCOLS FOR PESTICIDES AND PCB'S IN RAW WASTEWATER,
Little (Arthur D.), Inc., Cambridge, MA.
A. B. Caragay, and P. L. Levins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113184, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-166, November 1979. 108 p, 30 Fig, 40 Tab, 11 Ref, 2 Append. 68-01-3857.

Descriptors: *Testing procedures, *Pesticides, *Pollutant identification, *Analytical techniques, *Waste water(Pollution), Chromatography, Centrifugation, Waste identification, Chemical analysis, Water pollution sources, Aldrin, DDT, Dieldrin, Heptachlor, Chlorinated hydrocarbon.

Raw waste water from the municipal sewage treatment plant in Brockton, Massachusetts, was used to test the applicability of the Environmental Protection Agency protocol for screening industrial effluents for priority pollutions. Samples were analyzed both before and after dosing with 1-30 ppb of priority pesticides and PCB's. Among the pollutants tested for were alpha-, beta-, gamma-, and delta-BHC; heptachlor; aldrin; dieldrin; endrin; chlordane; toxaphene; arochlors; and others. The industrial protocol was adapted for raw waste water samples and the tests were designed to allow for the measurement of losses involved in each step. Protocol evaluation steps are: (1) extraction with 15% methylene chloride/hexane and centrifugation, (2) concentration by Kuderna-Danish evaporation, (3) interference removal by acetonitrile partition, (4) chromatography on Florisil and Sephadex LH-20, and (5) mercury treatment for sulfur removal. Assays were performed by gas chromatography using an electron capture detector. Results show that unless evaporation is performed rapidly the Kuderna-Danish step could cause significant sample loss. The use of mercury for extract clean up produces no significant pesticide loss. Use of the Sephadex LH-20 is recommended over the Florisil due to several clean up advantages. While the tested protocol worked well with pollutants at the ppb level there is some question about resolution at the ppt level. (Seigler-IPA)
W80-04300

FALLOUT PLUTONIUM IN AN ALKALINE, SALINE LAKE,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2H.
W80-04306

LOSS OF FLUOMETURON IN RUNOFF WATER,
Texas Agricultural Experiment Station, Bushland.
For primary bibliographic entry see Field 5B.
W80-04309

A SIMPLE TUBULAR PHYTOPLANKTON SAMPLER FOR VERTICAL PROFILING IN LAKES,
Ontario Ministry of the Environment, Ottawa. Water Resources Branch.
For primary bibliographic entry see Field 7B.
W80-04344

DIVERSITY AND INDICATOR SPECIES AS MEASURES OF WATER POLLUTION IN A SUBARCTIC LAKE,
For primary bibliographic entry see Field 5C
W80-04346

DESCRIPTION AND USE OF AN IMPROVED METHOD FOR DETERMINING ESTUARINE ZOOPLANKTON GRAZING RATES ON PHYTOPLANKTON,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.

F. B. Griffiths, and J. Caperon.
Marine Biology, Vol 54, No 4, p 301-309, 1979. 2 Fig, 4 Tab, 31 Ref.

Descriptors: *Zooplankton, *Phytoplankton, *Estimating equations, *Analytical techniques, *Grazing, Tracers, Radioactivity techniques, Feeding rates, Sampling, South West Arm(Australia), Port Hacking(Australia), Sydney(Australia), Australia, Plant populations, Estuarine environments, Standing crops, Estuaries, Laboratory tests, Saturation, Population dynamics.

A method developed for estimating zooplankton grazing rates on natural mixed phytoplankton populations does not depend on counting phytoplankton cells at the beginning and end of each experiment. The method involves adding C14-labelled, natural mixed phytoplankton populations, either as sole grazing substrate or as tracer, to mixed phytoplankton and zooplankton samples at ambient and above-ambient concentrations. Appearance rates of C14-labelled phytoplankton in zooplankton estimates the grazing rate. Experiments were conducted to measure following variables: (1) total zooplankton grazing rate; (2) phytoplankton concentrations necessary for saturated grazing to occur; (3) individual species grazing rates at ambient concentrations of both phytoplankton and zooplankton. Grazing rate constants for net-caught zooplankton concentrated to 46 and 28 times ambient estuarine levels are -0.14 and -0.12 phytoplankton standing stock/d, respectively. Amounts of phytoplankton grazed increase with increasing phytoplankton concentrations. The onset of saturated grazing occurs at concentrations 46 times ambient estuarine levels. However, observations were insufficient to establish absolute numerical values for saturated grazing. Experimental grazing rates, applied to phytoplankton standing stocks, October-November 1975 in South West Arm, Port Hacking, Australia, showed that zooplankton grazing was the major control factor of phytoplankton populations. (Harris-Wisconsin)
W80-04357

STAINING PREPARATIONS FOR PHYTOPLANKTON AND PERIPHYTON,
NUS Corp., Pittsburgh, PA. Ecological Sciences Div.
For primary bibliographic entry see Field 7C.
W80-04365

HYDROLOGIC CONDITIONS IN BROWARD COUNTY, FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04378

INTERACTIONS BETWEEN VASCULAR ACTIONS OF DETERGENT AND CATECHOLAMINES IN PERFUSED GILLS OF EUROPEAN EEL, ANGUILLA ANGUILLA L. AND BROWN TROUT, SALMO TRUTTA, L.,
Messina, Univ. (Italy). Dept. of Physiology.
L. Bolis, and J. C. Rankin.
Journal of Fish Biology, Vol 16, p 61-73, 1980. 9 Fig, 47 Ref.

Descriptors: *Toxicity, *Eels, *Brown trout, *Linear Alkylate Sulfonates, Animal physilogy, Detergents, Biochemistry, Inhibition, Animal metabolism, Chemical properties, Cytological studies, Mode of action, *Catecholamines, *Noradrenaline, *Gills, *Propanolol, *Tissue analysis.

Noradrenaline induced vasodilation in isolated perfused eel or trout gills was inhibited by propranolol, a beta - adrenergic blocking agent. The noradrenaline effect was much reduced in gills of fish which had been kept in 1 mg/l solutions of the detergent LAS (linear alkylate sulphonate; 12C chain length). LAS produced concentration-dependent vasodilation, which was inhibited by propranolol, in eel and trout gills. Noradrenaline produced additional vasodilation in eel and trout gills which had been dilated by 2 times ten to the minus eighth power M LAS but had no effect on trout gills perfused with 2 times ten to the minus seventh power M LAS. Gills from trout which had been kept in 0.1 mg/l LAS responded to noradrenaline normally but the propranolol inhibition appeared to be potentiated. (Deal-EIS)
W80-04388

EFFECTS OF SALINITY ON VEGETATION CONSUMPTION AND GROWTH IN GRASS CARP,
Florida, Univ., Gainesville. School of Forest Resources and Conservation.
M. J. Maceina, and J. V. Shireman.
The Progressive Fish-Culturist, Vol 42, No 1, p 50-53, 1980. 1 Tab, 26 Ref.

Descriptors: *Carp, *Salinity, *Growth rates, *Feeding rates, Habitats, Fry, Water chemistry, Toxicity, Fish behavior, Fish physiology, Salt tolerance, Brackish water, Freshwater fish, Animal metabolism, Grass carp, Estuaries.

Fingerling grass carp (Ctenopharyngodon idella), 90-130 mm long, were fed a satiation diet of duckweed (Lemna minor) at different salinities for a 14-day period. Daily food consumption ranged from 5.8 to 6.4% of body weight in fish held at salinities between 0.1 (fresh water) and 6 o/oo, declined significantly to 1.3% at 9 o/oo, and was nil at 12 o/oo. Dietary conversion rates of grass carp were less efficient at 3 and 6 o/oo salinity than in fresh water. Growth was reduced slightly at salinities of 3 and 6 o/oo and greatly at 9 o/oo. Consumption, growth, and survival data obtained in this study indicate that grass carp could inhabit brackish water estuaries and salt marshes of salinities up to 9 o/oo. (Deal-EIS)
W80-04395

THE EFFECT OF DISSOLVED OXYGEN AND SALINITY ON THE TOXICITY OF AMMONIA TO SMOLTS OF SALMON, SALMO SALAR L.,
Water Pollution Research Lab., Stevenage (England).
J. S. Alabaster, D. G. Shurben, and G. Knowles.
Journal of Fish Biology, Vol 15, p 705-712, 1979. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Dissolved oxygen, *Ammonia, *Toxicity, *Salinity, *Atlantic salmon, Mortality, Bioassay, Lethal limit, Water chemistry, Hardness(Water), Fish physiology, Salmonoids, Fish migration, *Acclimation.

The survival of Atlantic salmon smolts on exposure to constant concentrations of ammonia has been measured under laboratory conditions. At concentrations of dissolved oxygen close to the air-saturation value, the 24-h LC50 of unionised ammonia is 0.15 mg NH3/l in fresh water (hardness 264 mg/l as CaCO3) and 0.3 mg NH3/l in 30% sea water. At concentrations of dissolved oxygen of 3.5 mg/l in fresh water and 3.1 mg/l in 30% sea water, the 24-h LC50 is 0.09 mg NH3/l and 0.12 mg NH3/l respectively. For fish acclimated for 1 day to a concentration of ammonia close to the 24-h median for un-acclimated fish, the median is increased between 38 and 79%, depending on test conditions. (Deal-EIS)
W80-04397

THE EFFECTS OF INTERACTING SALINITY, CADMIUM, AND MERCURY ON POPULATION GROWTH OF AN ARCHIANNELID, DINOPHILUS GYROCILIATUS,
Oslo Univ. (Norway). Inst. of Marine Biology.
K. H. Roed.
Sarsia, Vol 64, p 245-252, 1979. 4 Fig, 6 Tab, 17 Ref.

Descriptors: *Salinity, *Mercury, *Cadmium, *Toxicity, Growth rates, Reproduction, Inhibition, Lethal limit, Mortality, Bioassay, Animal populations, Aquatic populations, Invertebrates, Worms, *Multivariate analysis, *Dinophilus.

After determining the 48-h LC50 values for cadmium and mercury, the long-term effects of 5% and 10% of these concentrations together with varying salinity on population growth progress of Dinophilus gyrociliatus O. Schmidt were investigated. Both the population growth rate and the time for the first generation to start reproduction have been studied. Significant effects were found for both two and three factor interactions. Using response surface methods, cadmium and mercury in combinations were shown to have increased effect as the salinity decreased and the two factor interactions were shown to change from antagonism at 30 o/oo to synergism at 25 o/oo. (Deal-EIS)
W80-04403

BEHAVIOURAL STUDIES ON MUSSELS UNDER CHANGING ENVIRONMENTAL CONDITIONS,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
J. Salanki.
Symposia Biologica Hungarica, Vol 19, p 169-176, 1979. 5 Fig, 20 Ref.

Descriptors: *Bioindicator, *Mussels, *Heavy metals, Animal behavior, Mercury, Cadmium, Insecticides, Herbicides, Pesticide toxicity, Water quality, Copper, Lead, *Anodonta.

The pumping behaviour of the fresh water mussel (Anodonta cygnea L.) was investigated under laboratory conditions with reference to artificial environmental factors, namely the presence of various pollutants. The continuous recording of shell activity and evaluation of changes in activity proved to be good indicators for testing the effect of chemicals. Mussels are rather sensitive to sulfhydryl blocking agents (Hg, Cd), which cause a marked shortening in their active periods. Some insecticides and herbicides shortening the mussels' activity also result in the reduction of water cleaning performed by mussels. (Deal-EIS)
W80-04404

EFFECT OF SOME PESTICIDES ON THE RHYTHMIC ADDUCTOR MUSCLE ACTIVITY OF FRESH-WATER MUSSEL LARVAE,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
I. Varanka.
Symposia Biologica Hungarica, Vol 19, p 177-196, 1979. 14 Fig, 1 Tab, 19 Ref.

Descriptors: *Pesticide toxicity, *Mussels, *Animal physiology, Larval growth stage, Inhibition, Insecticides, Nematocides, Herbicides, 2,4-D, Surfactants, Linear alkylate sulfonates, Bioindicator, Mollusks, *Tissue analysis, *Anodonta.

The toxicity of some pesticides which may enter fresh waters was examined on the larvae of freshwater mussels. The decrease of tryptamine (TA)-induced adductor muscle activity was used as an indicator of the effect because it seemed to be suitable for the investigation of inhibitory effects. The following compounds were used: insecticides: Hungaria L-7, Dimecron-50, Thimet-10 G, Novenda, Bi-58 EC and Malathion; a nematocide: Shell-DD; herbicides: Gramoxon, Dikonirt and its active ingredient, the pure 2,4-D salt, as well as LAS, a surface-active agent. (Deal-EIS)
W80-04406

CORRELATION BETWEEN CADMIUM CONCENTRATION IN THE WATER AND TISSUE RESIDUE LEVELS IN DAB, LIMANDA LIMANDA L., AND PLAICE, PLEURONECTES PLATESSA L.,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
H. Von Westernhagen, V. Dethlefsen, and H. Rosenthal.
Journal of the Marine Biological Association of the United Kingdom, Vol 60, p 45-58, 1980. 8 Fig, 2 Tab, 31 Ref.

Descriptors: *Cadmium, *Absorption, *Fish physiology, Water chemistry, Heavy metals, Growth rates, Toxicity, Mortality, Juvenile growth stage, Path of pollutants, Water temperature, Animal metabolism, Animal pathology, *Tissue analysis, *Bioaccumulation, *Dab, *Limanda, *Plaice, *Pleuronectes, *Fin erosion.

Juvenile dab, Limanda limanda L., and plaice, Pleuronectes platessa L., were kept in cadmium contaminated (5 microg/l, 50 microg/l) flow-through systems for 6 and 96 days. Accumulation of cadmium was measured in backbone, fins, gills, liver, muscle (fillet), otoliths and skin (dorsal and ventral). At both cadmium concentrations there was measurable accumulation after 6 days and significant accumulation in liver and gills after 96 days. At 50 microg/l, except for otoliths, all tissues tested showed significant uptake of cadmium. Growth and condition factors were not affected by either cadmium concentration. At 50 microg/l there was extensive mortality and plaice developed fin erosion. (Deal-EIS)
W80-04407

HUMAN IMPACTS ON BIOMASS, POPULATION SIZE AND YIELD-PER-RECRUITS OF ASP (ASPIUS ASPIUS L.) IN LAKE BALATON,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
P. Biro.
Symposia Biologica Hungarica, Vol 19, p 125-139, 1979. 12 Fig, 2 Tab, 26 Ref.

Descriptors: *Fish management, *Fish populations, *Commercial fishing, Productivity, Biomass, Yield equations, Mathematical models, Fish conservation, Commercial fish, Fish harvest, Nets, Lakes, Growth stages, Lake Balaton, Hungary, *Asp, *Aspius.

Responses of the relatively small asp (Aspius aspius L.) population to exploitation by commercial fisheries in Lake Balaton have been analysed. Yield of asp in Lake Balaton varied between 0.007 and 0.5 kg/ha. The quantity of asp caught annually at different areas of the lake is sufficiently constant (2.2-2.57 MT). The catch-per-unit effort (CPE) varied between 456 and 646 kg/yr, the rate of exploitation of the stock proved to be about 35.6 per cent, but the rate of production (P/B) was only 28.6 per cent. Annual loss of the population is about 49 per cent and the rate of survival is 51 per cent. The selectivity of the seines used in Lake Balaton basically influences the asymmetrical population structure removing the greater and older specimens of the stock. Asp in Lake Balaton basically influences the asymmetrical population structure removing the greater and older specimens of the stock. Asp in Lake Balaton has been intensively exploited. Rates of survival and exploitation heavily affect the size and stability of the harvestable asp population especially after the prerecruit phase. Rate of exploitation varies inversely in the function of stock abundance even at constant fishing effort. Under constant fishing pressure the stability and resilience of the relatively small asp population have been decreasing. These alterations are due to shifts in age-structure of the population and fluctuations in natural recruitment. These changes can be reversed to some extent by reducing the fishing intensity and enlarging the current mesh size of seines. (Deal-EIS)
W80-04409

OXYGEN-REGIME AND ARTIFICIAL AERATION OF NET-CAGES IN MARICULTURE,
Kiel Univ. (Germany, F. R.). Inst. fuer Meereskunde.
U. Kils.
Meeresforschung, Reports on Marine Research, Vol 27, No 4, p 236-243, 1979. 10 Fig, 11 Ref.

Descriptors: *Dissolved oxygen, *Aquiculture, *Equipment, *Oxygenation, Aeration, Oxygen requirements, Fish farming, Fish behavior, Flow rates, Water chemistry, Research equipment, Pumps, Fish management, *Artificial aeration.

The factors modifying the oxygen-regime in net-cages are shown and problems of artificial aeration pointed out. The only important 02-source of a net cage is the water exchange through the net-cover. The 02-content of the surrounding water, the stocking density and the net-cage size determine the oxygen-regime. A simple aeration with compressed air is not suitable for net-cages, on the contrary it can aggravate a critical 02-situation. A special net-cage-aerator is introduced and tested. This compact, self-floating aerator is easy to install in net-cages, delivers 02-saturated water without redundant turbulences and has a high oxygenation-capacity. An investigation on the fish reaction demonstrated that a net-cage-aerator of the displayed construction does not annoy the fishes in the cage. A swarm-like circular swimming motion of trout indensly stocked net-cages is not upset by the running aerator. (Deal-EIS)
W80-04410

SEASONAL AND ENVIRONMENTAL VARIATION IN MN, FE, CU AND ZN CONTENT OF SPARTINA ALTERNIFLORA,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. L. Gleason, J. E. Drifmeyer, and J. C. Zieman.
Aquatic Botany, Vol 7, p 385-392, 1979. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Seasonal, *Heavy metals, *Marsh plants, Manganese, Iron, Copper, Zinc, Marshes, Aquatic plants, Plant physiology, Metabolism, Absorption, Virginia, Bennett's Marsh, Taskinas Marsh, *Bioaccumulation, *Tissue analysis.

Mn, Fe, Cu, and Zn in shoot tissue of Spartina alterniflora L. were analyzed for seasonal trends and relationships to dry matter standing crop. Two brackish marshes in Virginia were sampled four times between April and September 1975. Between early April and late May shoots accumulated Mn, Cu and Zn at a faster rate than dry matter standing crop increased. Fe followed this trend at Bennett's Marsh but matched standing crop increase at Taskinas Marsh. Tissue concentrations of Mn, Cu and Zn declined over the growing season at both marshes; Fe declined at Bennett's Marsh and increased at Taskinas Marsh. (Deal-EIS)
W80-04411

TOXICITY OF HEAVY METALS TO THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW: CORRELATION BETWEEN TOXICITY AND METAL SPECIATION,
Melbourne Univ., Parkville (Australia). School of Botany.
G. S. Canterford, and D. R. Canterford.
Journal of the Marine Biological Association of the United Kingdom, Vol 60, p 227-242, 1980. 11 Fig, 3 Tab, 30 Ref.

Descriptors: *Heavy metals, *Toxicity, *Diatoms, *Mathematical models, Copper, Zinc, Cadmium, Lead, Chemical properties, Mercury, Chemical reactions, Chelation, Growth rates, *EDTA, *Silver, *Thallium.

Toxicity of copper, zinc, cadmium and lead to Ditylum brightwellii decreased as the EDTA concentration was increased. However, increasing the EDTA concentration from 6.7 x ten to the minus 7th power to .00001 M had no effect on the toxicity of mercury, silver and thallium. Using the computer program COMICS a model describing the speciation of copper, zinc, cadmium, lead, mercury, silver and thallium in Si02 Stosch-modified Schreiber medium containing 1 x ten to the minus 7th power to .00001 M EDTA was constructed. For copper, zinc, cadmium and lead the free metal concentration was dependent on the concentration of EDTA in the medium. However, for mercury, silver and thallium the free metal concentration was independent of EDTA concentration. Correlation between experimental and theoretical data shows that heavy metal toxicity to D. brightwellii was related to the free metal concentration in the medium rather than the total metal concentration. The order of metal toxicity, based on the free metal concentration, was Hg2+>Ag+>Cu2+>Pb2+>Cd2+>Zn2+>Tl+. (Deal-EIS)
W80-04414

THE SEA-WATER WELL SYSTEM AT THE FISHERIES LABORATORY, LOWESTOFT AND THE METHODS IN USE FOR KEEPING MARINE FISH,
Ministry of Agriculture, Fisheries and Food, Lowestoft, (England). Fisheries Lab.
P. Scholes.
Journal of the Marine Biological Association of the United Kingdom, Vol 60, p 215-225, 1980. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Marine fish, *Aquiculture, *Water wells, Sea water, Research equipment, Filtration, Sands, Fish management, Aquaria, Water chemistry, Fisheries, Marine fisheries, Water supply, Lowestoft, England.

A description is given of the shallow subsand seawater well system now in use at the Fisheries Laboratory, Lowestoft, England, to maintain for experimental purposes stocks of indigenous North Sea fishes. Chemical analyses of the well water show that it differs from usual inshore sea water in that it has a higher nitrate concentration and higher iron content, but fish both grow and spawn in this water and produce viable eggs and larvae. Advantages of the system are discussed. By provision of undergravel filtration fitted to individual tanks and an inflow of well water, whiting can be kept in a healthy condition at stocking densities of 10 kg cubic meter and flatfish such as dabs at 13 kg cubic meter. (Deal-EIS)
W80-04415

AN AQUATIC SAFETY ASSESSMENT ON LINEAR ALKYLBENZENE SULFONATE (LAS): CHRONIC EFFECTS ON FATHEAD MINNOWS,
Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
W. F. Holman, and K. J. Macek.
Transactions of the American Fisheries Society, Vol 109, p 122-131, 1980. 2 Fig, 8 Tab, 28 Ref.

Descriptors: *Linear alkylate sulfonates, *Toxicity, *Minnows, Detergents, Surfactants, Life cycles, Embryonic growth stage, Larval growth stage, Chemical properties, Organic compounds, Streams, Sewage effluents, Bioassay.

Life-cycle and embryo-larval toxicity tests were conducted on the fathead minnow (Pimephales promelas) with three commercial linear alkylbenzene sulfonates (LAS), anionic surfanctants commonly used in laundry detergents. The no-observed-effect concentration (NOEC), as measured in life-cycle tests or estimated from embryo-larval tests, depended on the mean alkyl chain length of the LAS and was 5.1 - 8.4, 0.48, and 0.11-0.25 mg/liter for C11.2, C11.7, and C13.3 LAS, respectively. The embryo and larval stages of development were consistently the most susceptible. The concentration of methylene blue active substances (MBAS), a nonspecific measure of anionic surfactants, was determined in over 800 widely distributed United States stream samples. The mean alkyl chain length of LAS in municipal sewage treatment effluents was C11.5. On the assumption that LAS contributes approximately 50% of the stream MBAS, 96 to 100% of the stream samples contained LAS at concentrations below the measured or estimated NOEC for fathead minnows. (Deal-EIS)
W80-04420

THE USE OF PERIPHYTON FROM LAKE ZURICH TO EXTIMATE THE ALGAL GROWTH POTENTIAL IN RIVER LIMMAT WATER,
Zurich Univ. (Switzerland). Hydrobiology-Limnology Station.
For primary bibliographic entry see Field 5C.
W80-04446

SUBFOSSIL CHIRONOMIDS AS EVIDENCE OF EUTROPHICATION IN EKOLN BAY, CENTRAL SWEDEN,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
For primary bibliographic entry see Field 5C.
W80-04453

ULTRAVIOLET RADIATION AND PHYTOPLANKTON PHOTOSYNTHESIS,

Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W80-04462

5B. Sources Of Pollution

EFFECT OF AGRICULTURE ON CEDAR LAKE WATER QUALITY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-04206

CALCULATION OF THE TOTAL ANTHROPOGENIC LEAD IN THE SEDIMENTS OF A RURAL ONTARIO LAKE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. D. Evans, and F. H. Rigler.
Environmental Science and Technology, Vol 14, No 2, p 216-218, February 1980. 2 Fig, 19 Ref.

Descriptors: *Lead, *Sediments, *Lake sediments, *Canada, Lakes, On-site investigations, On-site data collections, Sampling, Water pollution, Air pollution, Pollutants, Path of pollutants, Fallout, Data processing, Sedimentation, Anthropogenic lead.

Sediment cores from a rural Ontario lake (Bob Lake, latitude 44 deg 55 min N, longitude 78 deg 47 min W) were analyzed for total anthropogenic lead content. A high correlation between deposition of anthropogenic lead and sediment depth facilitated calculation of total fallout of anthropogenic lead in Bob Lake. The total fallout of 820 mg/sq m is large for a rural area in comparison to that calculated for the Lake Michigan-Chicago area (390 mg/sq m). (Sims-ISWS)
W80-04210

ACID PRECIPITATION IN THE WESTERN UNITED STATES,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 2K.
W80-04213

ORGANIC CONTAMINANT BEHAVIOR DURING GROUNDWATER RECHARGE,
Stanford Univ., CA.
For primary bibliographic entry see Field 5A.
W80-04219

RURAL NONPOINT SOURCE WATER QUALITY IN A SOUTHEASTERN WATERSHED,
North Carolina State Univ. at Raleigh.
F. J. Humenik, L. F. Bliven, M. R. Overcash, and F. Koehler.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 29-43, January 1980. 6 Fig, 8 Tab, 13 Ref. EPA R803328.

Descriptors: *Water quality, *Water pollution, *Watersheds(Basins), *North Carolina, *Virginia, *Atlantic Coastal Plain, Flow, Streamflow, Land use, Agriculture, Forests, Pollutants, Nutrients, Runoff, Water yield, Sampling, Data processing, *Nonpoint pollution.

Grab sample data from a 2-year study of forested and agricultural piedmont and well and poorly drained coastal plain areas of the Chowan River basin, Virginia-North Carolina, were analyzed to permit better understanding of rural runoff on an areawide basis. Mean nutrient concentrations for the four area types were relatively constant, but large spatial and temporal variations occurred within each area. There were large differences between data for piedmont and data for coastal plain, but variations between forested and agricultural piedmont and between well and poorly drained coastal plain were minor. Water and nutrient yields were greatest in winter and spring. Channelization of coastal streams appeared to promote high nitrate concentrations. (Sims-ISWS)
W80-04221

THE TRANSPORT AND OXYGEN DEMAND OF ORGANIC CARBON RELEASED TO RUNOFF FROM CROP RESIDUES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, and K. C. McGregor.
Progress in Water Technology, Vol 11, No 6, p 253-261, 1979. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Agricultural runoff, *Chemical oxygen demand, *Carbon, *Farm management, Sediments, Erosion, Biochemical oxygen demand, Water quality, Runoff, Crops, Corn(Field), Soils, Nutrients, Sampling, Data processing, Regression analysis, Agriculture, Crop residues, Tillage practices.

Chemical oxygen demand (COD), total organic carbon (TOC), and the 5-day biochemical oxygen demand (BOD sub 5) concentrations and losses were determined in runoff and sediments from conventional and no-till corn grown for silage (stalks removed) and for grain (stalks chopped and left on soil surface). Higher concentrations and losses of aqueous TOC and COD from grain plots resulted from organic carbon released from crop residues. Despite a wide range of residue management, one regression equation, $Y = 1.79X - 1.89$, related annual aqueous COD concentrations, Y in mg/l, to annual aqueous TOC concentrations, X in mg/l, for the research plots and watersheds. Although sediment TOC and COD concentrations (mg/kg) from the no-till grain and silage practices were considerably larger than those from comparable conventional practices, sediment TOC and COD losses from conventional practices were 6 to 13 times greater due to larger runoff and soil losses. While the annual average BOD sub 5 values were similar for the conventional silage and no-till for grain practices, 19.6 and 19.2 mg/l, respectively, these values differed seasonally. Where applicable, no-till seems to be a best management practice for corn to minimize the oxygen demand and losses of organic carbon in runoff from croplands. (Sims-ISWS)
W80-04226

SOURCES OF PHOSPHORUS IN THE LOUGH NEAGH SYSTEM AND THEIR REDUCTION,
Ministry of Agriculture, Crumlin (Northern Ireland). Freshwater Biological Investigation Unit.
R. V. Smith.
Progress in Water Technology, Vol 11, No 6, p 209-217, 1979. 4 Fig, 5 Tab, 6 Ref.

Descriptors: *Phosphorus, *Lakes, *Nutrients, Runoff, Water pollution, Sewage, Sewage treatment, Rivers, Watersheds(Basins), Drainage, Pollutants, Detergents, Sediments, Water pollution control, *Lough Neagh(Ireland).

Soluble reactive phosphorus is a critical nutrient in Lough Neagh and limits production of the algae in the lough. Accurate estimates of the input of soluble reactive P to the lough loads in each of the six major rivers were obtained by statistical modeling from continuous records of flow and concentrations of P measured every 8 days. Analysis of these data indicated that there was a significant correlation between the soluble reactive P loadings and the human, but not the animal, population densities of catchments. On the basis of the regression equations, the land drainage contribution of soluble reactive P was quantified as 0.14 kg P/ha/year and the rural per capita as 1.1 g P/person/day. If sewage works to towns of populations greater than 2000 were modified to incorporate P reduction stages, then about 40% of the available P to the lough could be curtailed. The effect of a complete detergent P ban would be to lower the sewage contribution of P by 50% loading to up to 40% curtailment of the available P input to the lough. Combining a ban and P reduction at sewage works could reduce the available P input by 60%. (Sims-ISWS)
W80-04227

POTENTIAL POLLUTANTS FROM AGRICULTURE--AN ASSESSMENT OF THE PROBLEM AND POSSIBLE CONTROL APPROACHES,
Cornell Univ., Ithaca, NY.
R. C. Loehr.
Progress in Water Technology, Vol 11, No 6, p 169-193, 1979. 10 Tab, 19 Ref, 1 Append.

Descriptors: *Water pollution, *Water pollution sources, *Agriculture, *Farm management, Farm wastes, Runoff, Fertilizers, Nutrients, Nitrogen, Phosphorus, Pollutants, Pesticides, Path of pollutants, Livestock, Feed lots, Crops, Soil conservation, Water pollution control, Erosion control, Reviews.

Agriculture has been identified as a potential source of water pollution as a result of: (1) the increasing intensity of many animal and crop producing operations; (2) the link that has been demonstrated between manure runoff, agricultural land runoff, and specific water pollution problems; and (3) the recognition, in certain areas, that control of municipal and industrial pollution may not be adequate to achieve desired water quality objectives. Although the relationships between animal and crop production practices, agricultural land use, and adverse impacts on water quality are largely empirical and general, there are approaches that can be used to minimize any adverse effect that agriculture might have. These approaches include runoff and erosion control practices; better timing and use of pesticides, fertilizers, and manure applications; and soil and water conservation practices. Many of these approaches are being utilized, and data on their effectiveness are available. This paper discussed both point and nonpoint potential agricultural pollutants in terms of: (1) sources, relative importance, and types of pollutants; (2) the magnitude of actual discharges; and (3) approaches and practices that can be used for the control of specific pollutants. (Sims-ISWS)
W80-04228

STUDIES ON THE CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF SOIL-FILTERED DAIRY-SHED EFFLUENT,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Div.
J. G. Cooke, R. W. Tillman, A. N. Macgregor, and J. K. Syers.
Progress in Water Technology, Vol 11, No 6, p 19-31, 1979. 2 Fig, 5 Tab, 14 Ref.

Descriptors: *Waste water disposal, *Dairy industry, *Effluents, *Irrigation, *Sampling, Drainage, Pastures, Nutrients, Nutrient removal, Pollutants, Path of pollutants, Pollutant identification, Nitrogen, Phosphorus, Biochemical oxygen demand, Bacteria, Coliforms, Suspended solids, Hydrogen ion concentration, Farm wastes, Soil water, Waste disposal, Land management.

The discharge from a drained pasture disposal site receiving milking shed wastewater was sampled intensively over several 24-hour periods. The effluent was characterized in terms of nutrients (N and P forms), oxygen demand, coliform bacteria, solids, and pH. The efficiency of the disposal area in 'filtering' the wastewater was calculated and was found to be relatively constant between runs, despite the fact that with seasonal variations in antecedent soil moisture and rainfall, there were large differences in the volume of drainage water discharged. The patterns of flow and composition of the discharge were investigated. It was concluded that it would be dangerous to sample only during or near the regular diurnal peaks in flow rate associated with the twice daily milking schedule, without further investigations of the relationship of the flow rate to the parameter concerned. It was estimated that a sampling interval of no greater than one hour was required to provide estimates of loadings which were within 10% of the true values over all runs and all parameters. (Sims-ISWS)
W80-04229

DYNAMICS OF DISSOLVED OXYGEN DURING ALGAL BLOOM IN LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ., Ikaraki (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W80-04242

POLIOVIRUS MOVEMENT DURING HIGH RATE LAND FILTRATION OF SEWAGE WATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
J. C. Lance, and C. P. Gerba.
Journal of Environmental Quality, Vol 9, No 1, p 31-34, January-March, 1980. 4 Tab, 15 Ref. EPA R-805,292.

Descriptors: *Viruses, *Sewage effluents, *Waste water(Pollution), *Groundwater recharge, *Land management, Infiltration, Sand aquifers, Water pollution sources, Filtration, Depth, Flow, Velocity, Adsorption, Loam, Wastes, Soils, Soil columns, Poliovirus movement, Secondary effluent, Sand filtration, Land application.

Research with soil columns that are good models of a field groundwater recharge system showed that most polioviruses are held near the soil surface. Secondary sewage effluent seeded with poliovirus type 1 (LSc) was filtered through 250-cm columns packed with calcareous sand from an area in the Salt River bed that is used for groundwater recharging of secondary sewage effluent. When the concentration of poliovirus added to the sewage water was increased from 0.9 x 100 to 2.6 x 10,000 PFU/ml, the number of viruses detected at each soil depth increased with the increasing virus concentration in the sewage water. However, the percentage of added viruses that remained at each depth was about the same for each concentration. The differences in the strength of the negative charge among members of a given viral population could account for the adsorption of some viruses near the soil surface while others move farther through the profile. Increasing the flow rate from 0.6 to 1.2 m/day caused a virus breakthrough of less than 1% of the added virus. However, 99% of the viruses still were removed from the infiltrating water at flow rates as high as 12 m/day. The velocity of water movement through the soil may be the single most important factor affecting the depth of virus penetration. (Visocky-ISWS)
W80-04245

FEASIBILITY OF WATER QUALITY IMPROVEMENT IN THREE ILLINOIS RIVERS,
Arizona Univ., Tucson. Dept. of Landscape Architecture.
D. C. Wilkin, and R. C. Flemal.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 293-298, February 1980. 10 Tab, 4 Ref.

Descriptors: *Water pollution sources, *Water quality, *Watersheds(Basins), *Rivers, *Illinois, Land use, Water pollution control, Water quality standards, Pollutants, Path of pollutants, Nitrogen, Ammonia, Iron, Copper, Lead, Phosphorus, Coliforms, Dissolved solids, Sampling, Data processing, Nonpoint pollution sources.

Three river basins in Illinois, varying in amount of urban and industrial development, have been studied to learn where pollution loadings originate and to determine what potential exists for water quality improvement. In all basins studied and for all constituents analyzed, complete elimination of all defined contributions would not greatly improve existing residual violation rates. Currently undefined contribution in these three basins, largely nonpoint-source pollution, holds the key to any substantive improvement. (Sims-ISWS)
W80-04246

CLOSTRIDIUM PERFRINGENS AS A WATER POLLUTION INDICATOR,
Health Effects Research Lab., West Kingston, RI.
J. W. Bisson, and V. J. Cabelli.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 241-248, February 1980. 4 Fig, 5 Tab, 13 Ref.

Descriptors: *Indicators, *Bioindicators, *Bacteria, *Tracers, Clostridium, E. Coli, Coliforms, Water pollution, Water pollution sources, Water quality, Monitoring, Sampling, Rivers, Estuaries, Beaches, Public health, Sewage effluents, Pollutants, Analytical techniques, Water pollution indicators.

Several potential applications of Clostridium perfringens as a water quality indicator were examined, including its use as an indicator of recreational water quality, a conservative tracer, a monitoring agent for chlorinated drinking water, and one component of indicator systems to determine the proximity and nature of sources of fecal pollution. The data from this preliminary study indicate that, while C. perfringens is not an appropriate indicator for recreational waters, it shows promise in the remaining areas, particularly as a conservative tracer and as a monitoring device for chlorinated drinking water. (Sims-ISWS)
W80-04247

THE CHEMISTRY OF THE RIVER WYE,
University of Wales. Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
A. C. Oborne, M. P. Brooker, and R. W. Edwards.
Journal of Hydrology, Vol 45, No 3/4, p 233-252, February 1980. 6 Fig, 7 Tab, 39 Ref.

Descriptors: *Rivers, *Water chemistry, *Water quality, Geologic control, River flow, Population, Land use, Spatial distribution, Runoff, Dry seasons, Wet seasons, Dissolved solids, Calcium, Magnesium, Sodium, Potassium, Bicarbonates, Silica, Nitrates, Phosphates, *Great Britain, *River Wye.

Samples collected during April 1975-December 1977 from 14 sites in the River Wye catchment were analyzed for total dissolved solids, calcium, magnesium, sodium, potassium, bicarbonate, reactive silica, nitrate, orthophosphate, suspended solids, and soluble organic carbon. The study period encompassed some of the most severe drought conditions recorded in the Wye catchment, and comparisons of the spatial and temporal variation in concentrations and mass flows of determinands were made from contrasting flow periods, September 1975-August 1976 (dry) and September 1976-August 1977 (wet), when flows in the lower Wye were 38% and 118%, respectively, of the longterm average. Spatial variations in water quality were related principally to geology (e.g., calcium) and population and land use (e.g., orthophosphate, nitrate). Significant flow-concentration relationships were established and, at all sites in both wet and dry periods, concentrations of most anions and cations were reduced by increased flow: nitrate and suspended-solids concentrations increased with increased flow. Annual subcatchment yields per unit area were substantially greater during the wet than the dry period and this was most marked in the lower catchment where differences in runoff between the two periods were greatest. Orthophosphate loads in both periods and nitrate loads in the dry period were significantly related to population density. (Visocky-ISWS)
W80-04248

BUFFERING OF SILICA AND PHOSPHATE IN A TURBID RIVER,
Maine Univ. at Orono, Walpole. Dept. of Oceanography.
L. M. Mayer, and S. P. Gloss.
Limnology and Oceanography, Vol 25, No 1, p 12-22, January 1980. 9 Fig, 36 Ref. NSF AEN72-03469, GI-34831.

Descriptors: *Silica, *Phosphates, *Rivers, *Turbidity, *Colorado River, Sediments, Dissolved solids, Sampling, Laboratory tests, Adsorption, Sorption, Chemistry, Water chemistry, *Buffering.

The buffering of riverine dissolved silica and phosphate by sorption reactions between the aqueous phase and suspended sediment was examined with the turbid Colorado River system as a model. Concentrations were found to lie in a range predicted from laboratory sorption experiments with natural sediments and waters. Phosphate was probably highly buffered by suspended sediment during river flow while silica was not. Silica appreciably affected phosphate sorption reactions but not vice versa. Increased temperature resulted in higher silica but lower phosphate concentrations as a result of sorption. The buffering action of suspended sediments was largely complete within a few hours and was approximately proportional to the concentration of suspended sediment. (Sims-ISWS)
W80-04252

MODELLING AND ANALYSIS OF DATA FROM CATCHMENT STUDIES OF LAND USE CHANGE,
National Research Advisory Council of New Zealand, Wellington.
For primary bibliographic entry see Field 2A.
W80-04254

DATA FILTERING TECHNIQUES AND REGIONAL ASSESSMENT OF AGRICULTURAL IMPACTS UPON WATER QUALITY, SOUTHERN ONTARIO,
Queen's Univ., Kingston (Ontario). Dept. of Geography.
E. D. Ongley, and L. H. Broekhoven.
Progress in Water Technology, Vol 11, No 6, p 551-577, 1979. 8 Fig, 4 Tab, 10 Ref.

Descriptors: *Water quality, *Land use, *Agriculture, *Great Lakes, Agricultural runoff, Water pollution, Water pollution sources, Watersheds(Basins), Drainage, Runoff, Pollutants, Dissolved solids, Suspended solids, Nitrogen, Nitrates, Ammonia, Phosphorus, Chlorides, Hardness(Water), Regression analysis, Correlation analysis, Analytical techniques.

The study examined the effect of agriculture relative to other land uses upon river water quality at a regional level using 49 nonpoint (diffuse) source and 52 point source drainage basins in southern Ontario, and which are tributary to Lakes Ontario, Erie, Huron, and connecting waterways. Methods of data filtering were examined, and substantive relationships among river water quality and categories of land use were identified. Water quality data were mean annual concentration for the period 1968-72 for nutrients and other physical and chemical variables. Land use variables employed a reduced set of Canada Land Inventory categories which include agricultural and urban variables. Filtering techniques included correlation, factor, and discriminant analyses. Factor analysis did not effectively group these variables. Alternatively, discriminant analysis offered a rapid and convenient method for identifying those independent variables responsible for variations in water quality. Correlation was used to examine those relationships among variables which were identified by discriminant analysis. Although urban variables appear to be responsible for extremely high levels of total nitrogen, and total and soluble phosphorus found in a few basins, cropland appears to influence levels of those attributes in basins representing the top one-third of ranked mean annual values. Cropland is the single discriminating variable for basins having large suspended sediment concentrations and is strongly related to nitrate levels. (Sims-ISWS)
W80-04255

HYBRID APPROACH IN WATER QUALITY MANAGEMENT,
Goettingen Univ. (Germany, F.R.). Fachbereich Physik.
For primary bibliographic entry see Field 5G.
W80-04256

LAND CAPABILITY FOR SURFACE WATER PRODUCTION,
Soil Conservation Authority of Victoria, Kew (Australia).
For primary bibliographic entry see Field 4A.
W80-04257

AGRICULTURAL LAND USE AND ITS EFFECT ON CATCHMENT OUTPUT OF SALT AND WATER--EVIDENCE FROM SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2F.
W80-04259

THE EFFECTS OF LAND USE AND HYDROLOGY ON GROUNDWATER QUALITY IN MID-CANTERBURY, NEW ZEALAND,
Ministry of Agriculture and Fisheries, Ashburton (New Zealand). Winchmore Irrigation Research Station.
For primary bibliographic entry see Field 5A.
W80-04261

THE EFFECTS OF IRRIGATION WITH MEATWORKS-FELLMONGERY EFFLUENT ON WATER QUALITY IN THE UNSATURATED ZONE AND SHALLOW AQUIFER,
Canterbury Frozen Meat Co. Ltd. Christchurch (New Zealand).
For primary bibliographic entry see Field 3C.
W80-04262

NITRATE AND CHLORIDE IN GROUNDWATER, SURFACE WATER AND DEEP SOIL PROFILES OF CENTRAL CANTERBURY, NEW ZEALAND,
Lincoln Coll., (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5A.
W80-04264

NITRATE REMOVAL FROM STREAMS DRAINING EXPERIMENTAL CATCHMENTS,
Ministry of Works and Development, Hamilton (New Zealand). Hamilton Science Centre.
R. A. Hoare.
Progress in Water Technology, Vol 11, No 6, p 303-314, 1979. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Nutrient removal, *Nitrates, *Streams, Nitrogen, Denitrification, Water quality, Land use, Springs, Sampling, Chemical analysis, Mathematical models, Water chemistry, Runoff, Rainfall, Watersheds(Basins), *New Zealand.

This paper showed that nitrate-nitrogen was naturally removed from the waters of a small stream, at a rate which can greatly affect estimates of the yield of nitrogen from the catchment. Four different methods were used to estimate the rate of nitrate-N removal, values for which were in the range of 0.2 to 0.9 g/sq m/day. These were similar to values found in other places where bacterial denitrification appeared to cause nitrate removal, but no conclusion can be drawn from this work about nitrate removal mechanisms acting in the catchment studied. These values, when interpreted with the aid of a simple mathematical model, suggested that it is likely that nitrate removal will be important in any comparison of catchments where the flow rate divided by streambed area in the first order tributaries is less than 5.9 cu m/sec/sq km. (Sims-ISWS)
W80-04265

MODELLING NITRATE CONCENTRATIONS IN PUMPED STORAGE RESERVOIRS,
Ministry of Works and Development, Hamilton (New Zealand). Hamilton Science Centre.
For primary bibliographic entry see Field 5G.
W80-04266

NUTRIENT CONCENTRATIONS IN RUN-OFF FROM A GLEY PODZOL SOIL,
Canterbury University, Christchurch (New Zealand). Dept. of Chemistry.
H. K. J. Powell, and M. C. Taylor.
Progress in Water Technology, Vol 11, No 6, p 295-301, 1979. 3 Fig, 10 Ref.

Descriptors: *Nutrients, *Runoff, *Pastures, *Nutrient removal, Agricultural runoff, Fertilizers, Phosphorus, Potassium, Sulfur, Calcium, Sampling, Chemical analysis, Water chemistry, Agriculture, *New Zealand.

Loss of nutrient in 'surface' runoff was studied for a pasture developed on a gley podzol soil under 2700 mm precipitation. The concentration of nutrients in runoff peaked significantly in the 3 months following fertilizer application (450 kg/ha of 30% potassic superphosphate), the relative concentrations being calcium greater than potassium greater than sulfur much greater than phosphorus. The mobility of nutrient in runoff was discussed in relation to the chemical properties of the soil and the levels of essential nutrients observed in pasture grass and clover. By ignoring base levels of nutrient arising from previous applications and from soil weathering, and assuming 0.8 for the fraction of precipitation appearing as 'surface' runoff, the estimated mass of nutrient lost (within 3-5 months of fertilizer application) was equivalent to 28% of potassium applied, 37% of sulfur, 40% of calcium, and 6% of phosphorus. (Sims-ISWS)
W80-04267

LOSSES OF PHOSPHORUS AND NITROGEN FORMS IN SUBSURFACE DRAINAGE WATER AS INFLUENCED BY PHOSPHATE FERTILIZER, GRAZING ANIMALS, AND IRRIGATION TREATMENTS,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
M. A. Turner, R. W. Tillman, and J. K. Syers.
Progress in Water Technology, Vol 11, No 6, p 287-294, 1979. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Nutrient removal, *Nitrogen, *Phosphorus, *Water quality, Agricultural runoff, Drainage, Tile drainage, Fertilizers, Grazing, Irrigation, Effects, Agriculture, *New Zealand.

The effects of phosphate (P) fertilizer, grazing animals, and irrigation treatments on losses of phosphorus (P) and nitrogen (N) forms in subsurface mole and tile drainage waters were investigated, under field conditions. Total P (TP) and total N (TN) losses ranged from 0.5-2.1 kg/ha and 7-43 kg/ha, respectively. For both P and N, most of the losses occurred as dissolved forms. Losses of dissolved inorganic P (DIP), total dissolved P (TDP), and TP were highest when all three treatments occurred together, intermediate with combinations of any two treatments, and lowest when only one treatment was present. For all comparisons, P fertilizer increased the losses of DIP, with the greatest increase being equivalent to approximately 1.8% of the P added. Losses of nitrate N (N03-N) and the percentage contribution of N03-N to total dissolved N (TDN) were highest with the grazing treatment. Grazing and irrigation treatments, and especially the interaction between the two, were important factors determining the magnitude of N03-N losses. (Sims-ISWS)
W80-04268

FACTORS AFFECTING DOWNSLOPE MOVEMENT OF NUTRIENTS IN HILL PASTURE,
Department of Scientific and Industrial Reseach, Lower Hutt (New Zealand). Soil Bureau.
R. H. S. McColl.
Progress in Water Technology, Vol 11, No 6, p 271-285, 1979. 3 Fig, 6 Tab, 17 Ref.

Descriptors: *Runoff, *Pastures, *Nutrients, *Overland flow, Agricultural runoff, Sampling, Rainfall, Organic matter, Dissolved solids, Nitrogen compounds, Nitrates, Phosphorus, Calcium, Magnesium, Sodium, Potassium, Fertilizers, Grazing, Sheep, Pollutants, Path of pollutants, Agriculture, *New Zealand.

Surface water was collected over 1 year during a study of the effects of season, sheep grazing, and fertilizer on downslope movement of nitrate, Kjeldahl nitrogen, phosphorus, calcium, magnesium, sodium, potassium, total solids, and organic matter in hill pasture, Taita, New Zealand. Nutrients moved short distances downslope in most rain events greater than 5 mm but long distances in three overland flow events during winter, which accounted for 75% of the year's water runoff. Estimates of the year's downslope movement showed that overland flow events accounted for about 60-80% of the nitrate, calcium, magnesium, sodium, total solids, and organic matter, and about 30-50% of the Kjeldahl nitrogen, total phosphorus, and potassium. About 45% of the Kjeldahl nitrogen and about 30% of the potassium moved downslope in events following within 5 days of grazing. About 34% of the total phosphorus movement occurred in two rain events following superphosphate application to recently grazed pasture; only 0.2% of the year's total moved in topdressed pasture with long grass. Estimated annual losses in surface water runoff (which was less than 1.2% of rainfall) from the experimental area were Kjeldahl nitrogen 0.59 kg/ha, nitrate nitrogen 0.23 kg/ha, and total phosphorus 0.11 kg/ha. These amounts of loss were less than atmospheric inputs. With the exception of rare overland flow events, the area studied did not contribute nutrients directly to streamflow as surface runoff from individual rain events and downslope movement was probably insignificant agriculturally. (Sims-ISWS)
W80-04269

EFFECTS OF RURAL AND URBAN SOURCES OF PHOSPHORUS OF LAKE BURLEY GRIFFIN,
Canberra Coll. of Advanced Education (Australia). School of Applied Science.
P. Cullen, and R. S. Rosich.
Progress in Water Technology, Vol 11, No 6, p 219-230, 1979. 6 Tab, 19 Ref.

Descriptors: *Phosphorus, *Lakes, *Sewage effluents, *Runoff, *Australia, Urban runoff, Agricultural runoff, Storm runoff, Monitoring, Sampling, Water pollution, Water pollution sources, Sediments, Eutrophication, Algae, Chlorophyll, Aquatic productivity, Nonpoint sources.

Lake Burley Griffin is a small (704 ha) artificial lake in the center of Canberra, Australia. Weekly monitoring of various forms of phosphorus to the lake over an 18-month period has enabled estimates to be made of phosphorus inputs and outputs from the lake. Flood events were shown to contribute 69% of the phosphorus, although these occupied only 9% of the study period. Of this flood phosphorus, 90% came from rural lands. Some 40% of the inflowing phosphorus was retained by the lake, mainly due to sedimentation. The application of the Vollenweider loading approach to the lake was discussed and compared to actual phosphorus concentration and biological production. (Sims-ISWS)
W80-04270

SPRAY IRRIGATION OF DAIRY FACTORY WASTEWATER ONTO PASTURE--A CASE STUDY,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
K. W. McAuliffe, K. D. Earl, and A. N. Macgregor.
Progress in Water Technology, Vol 11, No 6, p 33-43, 1979. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Waste water disposal, *Dairy industry, *Irrigation, *Pastures, Spraying, Effluents, Waste disposal, Nutrients, Phosphorus, Nitrogen, Soil water, Groundwater, Infiltration, Water table, Fertilizers, Dissolved solids, Suspended solids, Pollutant identification, Farm management, Soil science, Casein wastewater.

Analyses were made of soil, soil water, and groundwater parameters at a pasture disposal site which had received casein wastewater for approximately 15 years. Effluent composition analyses suggest that large quantities of nutrients, such as nitrogen and phosphorus, have been applied to the site. Marked increases in both the inorganic and organic fractions of these nutrients in the soil have occurred. Associated with the chemical property alternations are a number of physical and biological changes, such as lower bulk density, higher levels of soil respiration, and increased earthworm numbers. Soil water analyses indicated that large quantities of nitrogen and phosphorus may be leached to the groundwater although groundwater samples remained constantly low in N03-N and DIP levels, suggesting that any percolating nutrients are diluted by the rapidly flowing groundwater. The implications of wastewater disposal on farm management practices were also discussed. (Sims-ISWS)
W80-04271

QUALITY OF DRAINAGE WATER FROM PASTURE TREATED WITH DAIRY SHED EFFLUENT,

Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
A. N. Macgregor, J. D. Stout, and R. J. Jackson.
Progress in Water Technology, Vol 11, No 6, p 11-17, 1979. 1 Fig, 7 Tab, 9 Ref.

Descriptors: *Waste water disposal, *Dairy industry, *Effluents, *Irrigation, Drainage, Pastures, Pollutants, Path of pollutants, Pollutant identification, Nitrogen, Phosphorus, Bacteria, Coliforms, Soil water, Farm wastes, Nutrients, Nutrient removal, Waste disposal, Land management.

Dairy shed effluent was sprinkler irrigated onto intensively drained permanent pasture. Subsurface drainage water from the pasture disposal site was examined for the forms and amounts of nitrogen and phosphorus and the numbers of fecal coliform bacteria present. Although soil conditions that permitted rapid movement of waste components into the subsurface drainage prevailed at times, it was estimated that not less than 90% of the N and 98% of the P were removed by passage through the pasture-soil system. (Sims-ISWS)
W80-04272

DESCRIPTIVE AND COMPARATIVE STUDIES OF MAINE LAKES,
Maine Univ. at Orono. Life Sciences and Agriculture Experiment Station.
For primary bibliographic entry see Field 2H.
W80-04286

PLANT PATHOGENS AS AGENTS FOR BIOLOGICAL AND INTEGRATED CONTROL OF AQUATIC PLANTS,
Wisconsin Univ.-Madison. Dept. of Plant Pathology.
J. H. Andrews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-166473, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Completion Report 80-01, 1980. 36 p, 30 Fig, 6 Tab, 26 Ref. OWRT A-076-WIS(1), 14-34-0001-9053.

Descriptors: *Plant pathology, Pathogenic bacteria, Pathogenic fungi, *Plant diseases, Phytoplankton, Macrophytes, Plant groupings, *Aquatic weed control, Biocontrol, Eurasian water milfoil, Wisconsin, Lake Mendota(WI), Dane County(WI).

Field and laboratory observations were made during 1978 and 1979 on species composition and pathology of the phytoplankton and macrophyte communities in University Bay, Lake Mendota, Wisconsin. No evidence was found that pathogens play a significant role in the regulation of seasonal periodicity of phytoplankters or in inter-algal species competition. There was a pronounced general decline in macrophytes between 1978 and 1979 which may have been due to turbidity of the water. Disease appeared to be endemic rather than epidemic in the macrophyte community. All symptoms observed were in the atrophic or necrotic categories. Signs of disease were never apparent. Presumptive pathogens included fungi and bacteria obtained as singular and consistent isolates from surface-sterilized stem or leaf lesions. Demonstration of causality of fulfillment of Koch's Postulates was completed for Fusarium sporotrichioides, which causes stem lesions and apical chlorosis on Eurasian watermilfoil (Myriophyllum spicatum L.). Other presumed pathogens were isolated from milfoil following reinoculation, but did not induce characteristic symptom development. A fungus, identified tentatively as Trichothecium, grew endophytically in Eurasian milfoil and was associated with decline of the plant. Endophytic microorganisms appeared to be common in macrophytes and may offer the best prospect for biological suppression, or as the biological component of an integrated strategy for the control of nuisance aquatic macrophytes.
W80-04290

DISSOLVED OXYGEN IMPACT FROM URBAN STORM RUNOFF,
Sutron Corp., Arlington, VA.
T. N. Keefer, R. K. Simons, and R. S. McQuivey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-138266, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-156, November 1979. 248 p, 11 Fig, 18 Tab, 11 Ref, 4 Append. 68-03-2630.

Descriptors: *Dissolved oxygen, *Urban runoff, *Storm runoff, *Surface runoff, *Water pollution sources, Combined sewers, Water quality, Monitoring, Rainfall, Gaging stations, Streamflow, Correlation analysis.

Data from 104 water quality monitoring sites in and downstream of urban areas were evaluated to determine the correlation and the magnitude of the correlation between storm runoff and dissolved oxygen deficits downstream of urban areas. Of the 104 stations only 83 had sufficient data to produce results: 55 U.S. Geological Survey monitors, 17 STORET system monitors, and 11 Wisconsin Department of Natural Resources monitors. Forty-two percent of the monitors examined showed a 60% or more probability of a higher than average dissolved oxygen deficit for times of high stream flow or rainfall. This 60% probability was not found for all years at any given station but a frequency of 3 years in 5 was typical. At 22 of the monitor sites detailed hourly analysis show a diurnal cycle for dissolved oxygen concentrations. This cycle disappears during a storm event as flow increases and dissolved oxygen concentrations fall 1 to 1.5 mg/l below the minimum of the normal diurnal cycle low for one to five days. Dissolved oxygen levels of less than 5.0 mg/l were used as a standard for the study. Overall the probability is one in three that analysis of data from the monitors near urban areas will show a correlation between high flow and/or rainfall events and high dissolved oxygen deficits. The data base used for the correlation is not geographically homogeneous so no national conclusions can be drawn. (Seigler-IPA)
W80-04297

VERIFICATION OF THE WATER QUALITY IMPACTS OF COMBINED SEWER OVERFLOW,
Rexnord Inc., Milwaukee, WI. Environmental Research Center.
T. L. Meinholz, W. A. Kreutzberger, M. E. Harper, and K. J. Fay.
Environmental Protection Technology Series Report No EPA-600/2-79-155, December 1979. 200 p, 68 Fig, 29 Tab, 33 Ref, 2 Append. R-804518.

Descriptors: *Milwaukee River, *Combined sewers, *Dissolved oxygen, *Mathematical models, Water pollution sources, Coliforms, Urban runoff, Bottom sediments, Suspended solids, Oxygen demand, Water quality, Dredging, Regression analysis, Flow rates.

Water quality impacts in the Milwaukee River in terms of dissolved oxygen (DO) and fecal coliform concentrations following wet weather discharges were studied and modeled with a modified Harper's water quality model. Intensive field surveys and river dye studies show that river velocity is extremely slow in the lower reach near Lake Michigan even during high flow periods. Due to this slowness sediments accumulate in the lower river forming a significant sink for DO. Oxygen demand for these sediments when disturbed can be as high as 1000 gm/sqm-day or more than 100 times greater than the demand for undisturbed sediments. A rapid decline in DO is often observed following combined sewer overflows (CSO) that cannot be entirely attributed to the loadings from the CSO. The rapid DO decline is linked to the scouring of sediment oxygen demand by submerged CSO outfalls. Using regression analysis empirical equations were developed to predict CSO sediment scouring impacts on DO. Harper's water quality model was modified, calibrated, and verified for the simulation of fecal coliform and DO river conditions with various dry, wet, and CSO events. It is recommended that the feasibility of a periodic dredging program for the river be examined as a means of alleviating the DO problems. (Seigler-IPA)
W80-04299

METHANE ADDITION TO AN ARCTIC LAKE IN WINTER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
H. E. Welch, J. W. M. Rudd, and D. W. Schindler.
Limnology and Oceanography, Vol 25, No 1, p 100-113, January 1980. 12 Fig, 5 Tab, 20 Ref.

Descriptors: *Methane, *Lakes, *Winter, *Arctic, Effects, Dissolved oxygen, On-site investigations, Ice cover, Hydrogen ion concentration, Alkalinity, Carbon, Electrical conductance, Nitrogen, Phosphorus, Silica, Chlorides, Water chemistry, Pollutants, Water pollution, Path of pollutants.

The possible use of buried pipelines to transport natural gas (about 99% methane) through the Canadian arctic prompted a study of some of the dynamics of methane metabolism in an arctic lake at 63 deg 38 min N Lat. The two basins of the lake were separated during winter 1977-1978 by a curtain, and 300 kg of methane was dissolved into one side, to a maximum of 120 micro M/liter or 0.7 M/sq m. Oxidation occurred throughout the water column, but the highest rates were at or near the sediment surface. High phosphate and nitrate additions did not stimulate oxidation. The sediments generated methane naturally, and winter concentrations in undisturbed lakes were 0.2-1.0 micro M/liter. The added methane disappeared at a slow, steady rate of 1.89 mM/sq m/d or 0.32 micro M/liter/d from February to June. The oxygen depletion rate of the entire experimental basin was 0.244 g/sq m/d, compared with 0.210 in the control basin, and was not measurably affected by artificially added methane; a winter pipeline rupture would therefore probably not result in severe oxygen depletion in downstream lakes. These and other results were not expected based upon knowledge of methane dynamics in temperate lakes. (Sims-ISWS)
W80-04308

LOSS OF FLUOMETURON IN RUNOFF WATER,
Texas Agricultural Experiment Station, Bushland.
A. F. Wiese, K. E. Savage, J. M. Chandler, L. C. Liu, and L. S. Jeffery.
Journal of Environmental Quality, Vol 9, No 1, p 1-5, January-March 1980. 2 Fig, 5 Tab, 29 Ref.

Descriptors: *Pesticides, *Herbicides, *Runoff, *Water pollution sources, Sampling, On-site investigations, On-site data collections, Chemical analysis, Agricultural runoff, Pollutants, Path of pollutants, Pollutant identification, Agriculture, *Fluometuron.

The amount of fluometuron in runoff water under different environmental conditions was determined in the southern U.S. and Puerto Rico. In Mississippi, Puerto Rico, and Texas, runoff water was collected from soil sprayed with 4.4 kg/ha of fluometuron each year for 3 years. Tests were conducted in Tennessee for 2 years and in North and South Carolina for 1 year. Water samples were collected in 4- by 10-m plots, and 1 m downslope. Initial runoff was produced with sprinkler irrigation immediately after herbicide application at all locations except Tennessee and South Carolina which relied on rainfall. Later in the season, water was sampled from two additional runoff events of either irrigation or rainfall. A total of 32 runoff events were sampled at the 6 locations. The level of fluometuron in water caught 1 m downslope from treated areas during the first runoff averaged 0.30 ppm and was highest (0.87 ppm) in Puerto Rico. Fluometuron concentration in subsequent events was much lower than in the first runoff events. Average loss of fluometuron in 1 cm of runoff was less than 1% of applied fluometuron. Only 2% of applied fluometuron was lost in the situation producing the highest concentration in runoff water. Level of fluometuron in runoff water was directly related to slope. Results of this study indicated that fluometuron concentrations in runoff from treated fields are such that nontarget species should not be adversely affected. (Sims-ISWS)
W80-04309

DESIGN CRITERIA FOR COOLING-WATER OUTLET STRUCTURES,
Karlsruhe Univ., (Germany, F.R.).
M. Schatzmann, and E. Naudascher.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15239, p 397-408, March 1980. 8 Fig, 1 Tab, 10 Ref.

Descriptors: *Cooling water, *Dispersion, *Rivers, *Model studies, Mathematical models, Hydraulic models, Outlet works, Water pollution, Thermal pollution, Effluents, Design, Environmental engineering.

This paper described some laboratory studies utilizing buoyant and nonbuoyant tracers to investigate the effects of the initial conditions on the lateral mixing of cooling water or wastewater discharge into rivers. The paper began with a short phenomenological description of the dispersion of cooling-water side discharges into rivers from which a concept for quantifying the effect of the outfall parameters on the near-field mixing is then deduced. By means of a virtual-source concept and two bulk parameters describing the stability of the near-field density stratification and the strength of an assumed reference source, the results can be presented in a straightforward graphical form. These graphs provide a first estimate of design criteria for an outlet structure which is to be designed to maximize the rate of near-field mixing for a given cooling-water discharge. (Sims-ISWS)
W80-04310

EFFECTIVENESS OF SUBMERSED ANGIOSPERM-EPIPHYTE COMPLEXES ON EXCHANGE OF NUTRIENTS AND ORGANIC CARBON IN LITTORAL SYSTEMS. III. REFRACTORY ORGANIC CARBON,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
A. M. Mickle, and R. G. Wetzel.
Aquatic Botany, Vol 6, No 4, p 339-355, August 1979. 9 Fig, 25 Ref. NSF BMS-75-20322, DEB-75-203220A01, DOE EY-76-S-02-1599, COO-1599-142.

Descriptors: *Macrophytes, *Organic compounds, *Littoral, *Fulvic acids, *Nutrient removal, Scirpus, Myriophyllum, Pollution abatement, Plant physiology, Seasonal, Metabolism, Epiphytes, Organic matter, Organic loading, Biochemistry, Allochthonous material, Filters, Organic acids.

Submersed macrophyte-epiphyte complexes possess physical and metabolic mechanisms which substantially reduce the quantity and quality of allochthonous refractory organic compounds entering a lake. While some of these compounds entering a lake littoral zone pass through unchanged, a large portion interacts with the macrophyte-epiphyte complex. Experiment results suggest that macrophyte-epiphyte complexes are effective in removing refractory organic compounds; however, this effectiveness varies with season and species. Experimental design is comprised of two continuously flowing systems: System I contains a natural Scirpus subterminalis population and System II contains Myriophyllum heterophyllum. Epiphytes are left intact. Refractory dissolved organic compounds, consisting mainly of fulvic acids labelled with C14, are added to inflow water. DOC concentrations in outflow waters from littoral complexes of both experimental systems are higher than those from control (no plant) complexes. This increase is evident in DOC of compounds $>$ 1000 Daltons in System II; in System I, this increase occurs in DOC $>$ 10,000, but mainly in compounds $>$ 30,000 Daltons. Outflow waters from experimental littoral complexes show a substantial decrease in calcium concentration. This reduction is caused by CaCO3 precipitation induced by photosynthesis. UV absorption and flourescence are higher in littoral complex outflow waters than in control outflow waters. The difference is much greater in System I than System II; this results from continual senescence by the perennial Scirpus species. (Danovich-Wisconsin)
W80-04348

ACTIVE WASTE-INJECTION SYSTEMS IN FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Vecchioli, D. J. McKenzie, C. A. Pascale, and W. E. Wilson.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO 80225. Paper copy $4.50, Microfiche $3.50. Geological Survey open-file report 79-1296, 1979. 33 p, 13 Fig, 1 Tab, 27 Ref.

Descriptors: *Waste disposal, *Injection wells, *Liquid wastes, *Monitoring, Aquifers, Industrial wastes, Sewage, Water pollution sources, Data collections, Florida.

As of the end of 1976, seven systems were injecting liquid wastes into Florida's subsurface environment at a combined average rate of 15 million gallons per day. This report presents for each of these systems information on the kind and amount of waste injected and type of pretreatment, construction characteristics of the injection and monitor wells, type of test and monitoring data available, and brief discussion of any operational problems experienced. (Kosco-USGS)
W80-04368

SUMMARY OF HYDROLOGIC DATA FOR TAMPA BYPASS CANAL SYSTEM, JULY 1974 TO SEPTEMBER 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 8B.
W80-04373

A PROPOSED GROUND WATER QUALITY MONITORING NETWORK FOR IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-04374

STORMWATER-RUNOFF DATA FOR A MULTIFAMILY RESIDENTIAL AREA, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04375

QUALITY OF SURFACE WATER ON SANIBEL ISLAND, FLORIDA, 1976-77,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. F. McPherson, and T. H. O'Donnell.
Available from: OFSS/USGS Box 25425, Fed. Ctr. Denver, CO, Paper copy $7.25 Microfiche $3.50. Geological Survey open-file report 79-1478, 1979. 50 p, 14 Fig, 12 Tab, 6 Ref.

Descriptors: *Water quality, *Surface waters, *Florida, *Surface-groundwater relationships, *Pollutants, Water pollution sources, Saline water intrusion, Artesian aquifers, Sampling, Sites, Water resources, Hydrologic data, *Sanibel Island(Fla).

The quality of surface water in parts of the interior of Sanibel Island, Fla., has been periodically degraded by high concentrations of salt or macronutrients and by low concentrations of dissolved oxygen. In 1976 the chloride concentration of surface water ranged from about 500 milligrams per liter to almost that of seawater, 19,000 milligrams per liter. The highest salinities were during the dry season of 1976 in the Sanibel River near the Tarpon Bay control structure and are attributed to leakage of saline water past the structure. The highest concentrations of macronutrients occurred during the dry season in the eastern reach of the Sanibel River, where concentrations generally exceeded 4.0 milligrams per liter total nitrogen and 0.9 milligrams per liter total phosphorus. Concentrations of dissolved oxygen were lowest in the wet season along an eastern reach of the Sanibel River and in several nearby ponds and canals where near-anaerobic conditions prevailed. The high concentration of macronutrients and the low dissolved oxygen are attributed, in part, to urban and sewage effluent that flow directly or seep into surface water. (Kosco-USGS)
W80-04377

GROUND-WATER QUALITY IN THE UPPER SANTA ANA RIVER BASIN, SOUTHERN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. A. Eccles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-161888, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-113, December 1979. 51 p, 15 Fig, 2 Tab, 11 Ref.

Descriptors: *Groundwater, *Water quality, California, *Water pollution sources, *Nitrates, Dissolved solids, Model studies, Water wells, Sampling, Monitoring, Networks, Chemical analysis, *Upper Santa Ana River basin(Calif).

The principal ground-water quality problems in the Santa Ana River basin, as determined from two samplings (1968-69 and 1977-78), are high concentrations of dissolved solids in general and nitrate-nitrogen in particular. The distribution of dissolved solids exceeding 800 milligrams per liter was smaller in area in 1977-78 than in 1968-69. Distribution of nitrate-nitrogen exceeding 10 milligrams per liter was larger in area in 1977-78 than in 1968-69. Concentrations of dissolved solids and nitrate-nitrogen decreased with depth. The network of wells used in the 1977-78 sampling program provides only a general appraisal of overall quality for most of the upper Santa Ana River basin. It is not adequate for detailed appraisals of specific problem areas because it lacks sufficient areal coverage and construction information for the wells sampled. (Kosco-USGS)
W80-04383

RESPONSE OF THE TENCH (TINCA TINCA L.) TO POTASSIUM NITRATE ENRICHED WATER,
Lyon-1 Univ., Villeurbanne (France). Lab. de Physiologie Generale et Comparee.
A. Demael, D. Garin, and G. Peres.
Journal of Fish Biology, Vol 16, p 15-22, 1980. 7 Tab, 22 Ref.

Descriptors: *Fish physiology, *Toxicity, *Potassium, Animal metabolism, Membrane processes, Osmosis, Ions, Water chemistry, Chemical reactions, Biochemistry, Sodium, Electrolytes, Freshwater fish, Potassium nitrate, *Tench, *Tinca, *Osmoregulation, *Blood chemistry, *Tissue analysis.

When the tench (Tinca tinca L.) was exposed to a slight increase, 8.5 mg/l, in the potassium content of the water, metabolic and hormonal changes occurred which lasted more than four weeks. An initial phase of lipolysis was followed by a partial consumption of glycogen reserves, which in turn was followed by a phase of gluconeogenesis. Hyperglycaemia persisted throughout the experiment. The ion distribution in erythrocytes and liver changed relatively early; there was no observable change in water content. These changes are similar to those observed during the osmoregulation of fish. (Deal-EIS)
W80-04387

BIOACCUMULATION AND BIOAMPLIFICATION OF MERCURY COMPOUNDS IN A THIRD LEVEL CONSUMER, SALMO GAIRDNERI, INFLUENCE OF THE TEMPERATURE FACTOR (IN FRENCH),
Bordeaux-1 Univ., Talence (France). Lab. d'Ecologie Animale.
A. Boudou, F. Ribeyre, A. Delarche, and R. Marty.
Water Research, Vol 14, p 61-65, 1980. 6 Fig, 8 Ref, (English abstract).

Descriptors: *Mercury, *Food chains, *Path of pollutants, Heavy metals, Trophic level, Rainbow trout, Chlorella, Chlorophyta, Daphnia, Livebearers, Mortality, Bioassay, Water chemistry,

Water temperature, *Bioaccumulation, *Bioamplification, *Tissue analysis.

The bioaccumulation and bioamplification of mercury compounds in a third level consumer, Salmo gairdneri have been quantified. The direct contamination is analysed by mortality tests and by metal dosing both in fish and in their principal organs. This study was made with regard to the chemical form of the pollutant (HgCl2 and CH3HgCl), the dose introduced in the environment, the length of contamination, and the temperature. An interspecific comparison of the direct toxicity is made with Carrassius carrassius. The global contamination (water and food) was quantified using an experimental trophic chain of four levels: Chlorella vulgaris, Daphnia magna, Gambusia affinis and Salmo gairdneri. The methyl-mercury concentration in the water was 1 ppb, the water temperature was 10, 18 and 26C and the length of contamination was 10 and 30 days. The mercury bioaccumulation, expressed by means of concentration factors with regard to the contaminant dose in the water, is strongly influenced by the temperature: 2500 at 10C, 5900 at 18C and 3100 at 26C. Our results show the clear preponderance of the trophic contamination with regards to the direct contamination. (Deal-EIS)
W80-04396

PESTICIDE RESIDUES IN LAKE BALATON,
Heavy Chemical Industry, Veszprem (Hungary). Research Inst.
G. Y. Pfeifer, J. E. Ponyi, and Z. Nagy.
Symposia Biologica Hungarica, Vol 19, p 21-26, 1979. 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Pesticide residues, *Lakes, DDT, Chlorinated hydrocarbon pesticides, 2,4-D, DDE, Herbicides, Chemical analysis, Water chemistry, Plankton, Mussels, Carp, Organophosphorus pesticides, Gas chromatography, *BHC, *Lindane, *Bream, *Abramis, *Tissue analysis, *Bioaccumulation.

No residues of chlorinated hydrocarbons, e.g. DDT and metabolites and BHC isomers, have lately been found in samples of water, plankton, mussel and fish (bream, Abramis brama L. and carp, Cyprinus carpio L.) from Lake Balaton. In the liver and fat of pikeperach (Stizostedion lucioperca L.) lindane has been found (10-30 ppb) but this value is not statistically significant because of the limited number of samples. The lake seems to be free of chlorinated insecticide residues due to the total ban of DDT and other chlorinated type insecticides in 1970. A residue of 2,4-D has been found in the water samples collected from the lake. (Deal-EIS)
W80-04402

CORRELATION BETWEEN CADMIUM CONCENTRATION IN THE WATER AND TISSUE RESIDUE LEVELS IN DAB, LIMANDA LIMANDA L., AND PLAICE, PLEURONECTES PLATESSA L.,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W80-04407

SEASONAL AND ENVIRONMENTAL VARIATION IN MN, FE, CU AND ZN CONTENT OF SPARTINA ALTERNIFLORA,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W80-04411

COPPER-THE MAJOR METAL COMPONENT OF GLYCERID POLYCHAETE JAWS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
P. E. Gibbs, and G. W. Bryan.
Journal of the Marine Biological Association of the United Kingdom, Vol 60, p 205-214, 1980. 1 Fig, 6 Tab, 17 Ref.

Descriptors: *Copper, *Polychaetes, *Zinc, Calcium, Magnesium, *Iron, Sulfur, Chlroine, Manganese, Metals, Chemical analysis, Spectrophotometry, Animal physiology, Animal metabolism, *Tissue analysis, *Bioaccumulation, Glycera.

Analyses of the jaws of the glycerid polychaete Glycera gigantea show that copper is the principal metal component, accounting for about 1.5% of the dry weight and representing up to 67% of the total body burden of copper. The copper is concentrated in the distal tip of the jaw where the concentration is as high as 13%. Other metals in the jaws include zinc, calcium and magnesium which together account for about a further 1% of the dry weight; the iron content is low. Sulphur and chlorine are also present in appreciable quantities. A high copper level is also present in the jaws of G. convoluta, G. lapidum and G. rouxi. Although the copper concentration in the body of G. convoluta may be markedly increased at contaminated sites, the copper concentration in the jaws does not appear to be influenced by the environmental level; evidently a high copper level is a structural feature of the glycerid jaw. Zinc levels in both jaws and bodies remain fairly constant despite wide environmental variations. (Deal-EIS)
W80-04413

MERCURY IN WATER, ORGANISMS AND SEDIMENTS FROM A SECTION OF THE TURKISH MEDITERRANEAN COAST,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Sciences.
G. Tuncel, G. Ramelow, and T. I. Balkas.
Marine Pollution Bulletin, Vol 11, p 18-22, 1980, 1 Fig, 7 Tab, 15 Ref.

Descriptors: *Mercury, *Baseline studies, Heavy metals, Water chemistry, Marine fish, Bottom sediments, Chemical analysis, Mullets, Coasts, Industrial wastes, *Mediterranean Sea, *Turkey, *Tissue analysis, *Bioaccumulation.

Samples of water, marine organisms and sediment collected along the Turkish Mediterranean coast in the vicinity of Mersin were analysed for total mercury. The levels of mercury found in the samples from this area are generally low in comparison with the levels found in other regions of the Mediterranean. (Deal-EIS)
W80-04417

CHLORINATED HYDROCARBONS IN FISH-EATING BIRDS FROM THE GDANSK BAY, BALTIC SEA,
Morski Inst., Gdansk (Poland).
R. Dubrawski, and J. Falandysz.
Marine Pollution Bulletin, Vol 11, p 15-18, 1980. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Pesticide residues, *Water birds, *Chlorinated hydrocarbon pesticides, *Migratory birds, DDT, Polychlorinated biphenyls, Chemical wastes, Industrial wastes, DDD, DDE, Chemical analysis, Gas chromatography, *HCB, *Tissue analysis, *Bioaccumulation.

Chlorinated hydrocarbons in industrial and agricultural use are found at significant concentrations in coastal regions. This paper reveals concentrations of HCB, DDT and PCB in tissues of the fish-eating birds staying at their winter quarters in the South Baltic. The species analyzed were: Great Crested Grebe (Podiceps cristatus); Slavonian Grebe (Podiceps auritus); Black Guillemot (Cephus grylle); Goosander (Mergus merganser); and, Black-Throated Diver (Garia arctica). The results were compared to other studies on these species. (Deal-EIS)
W80-04419

FACTORS CAUSING ELEVATED BIOLOGICAL OXYGEN DEMAND IN THE LITTORAL ZONE OF LAKE WINGRA, WISCONSIN,
Wisconsin Univ., Madison. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-04457

IMPACT OF THE 1977 CLEAN WATER ACT AMENDMENTS ON INDUSTRIAL DISCHARGERS,
Morgan, Lewis and Bockius, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04487

NONPOINT POLLUTION CONTROL IN VIRGINIA,
For primary bibliographic entry see Field 6E.
W80-04500

5C. Effects Of Pollution

AVAILABILITY TO SCENEDESMUS QUADRICAUDA OF DIFFERENT FORMS OF PHOSPHORUS IN SEDIMENTARY MATERIALS FROM THE GREAT LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
J. D. H. Williams, H. Shear, and R. L. Thomas.
Limnology and Oceanography, Vol 25, No 1, p 1-11, January 1980. 2 Fig, 4 Tab, 38 Ref.

Descriptors: *Sediments, *Phosphorus, *Algae, *Lake sediments, *Great Lakes, Suspended solids, Erosion, Bank erosion, Sampling, Laboratory tests, Nutrients, Pollutants, Water pollution, Water pollution effects, Lakes, Limnology.

Sedimentary materials from eroding bluffs, suspended solids in streams, and lake bottom sediments from Lakes Ontario and Erie were cultured with the alga Scenedesmus quadricauda (Turp.) de Brebisson in modified Rodhe's medium with the sediments as the sole source of P. P uptake by the algae was related to the amount of nonapatite inorganic phosphorus in the sediments. Apatite phosphorus was not used, and the bluff samples, in which over 90% of total P was in this form, did not support algal growth. The nonapatite inorganic P fraction was highly correlated with the amounts of inorganic phosphorus extracted by three standard techniques for estimating 'available P' (extraction by NaOH and nitrilotriacetic acid solutions and by H-resin), and cell uptake equaled NaOH-extractable inorganic P in several instances. Uptake of P by the cells varied from 8 to 50% of total P and from 38 to 83% of nonapatite inorganic P when measured directly. Organic phosphorus in the sediments was not utilized by the algae. Percentage utilization of total P was in general highest when total P concentration in the sediments was itself high. (Sims-ISWS)
W80-04253

DISTRIBUTION, FLUXES AND BIOLOGICAL UTILIZATION OF INORGANIC NITROGEN DURING A SPRING BLOOM IN THE NEW YORK BIGHT,
Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
H. L. Conway, and T. E. Whitledge.
Journal of Marine Research, Vol 37, No 4, p 657-668, November 1979. 4 Fig, 2 Tab, 30 Ref. DOE EY-76-C-02-0016.

Descriptors: *Ammonia, *Nitrates, *Phytoplankton, *New York Bight, *Nitrogen cycle, *Cycling nutrients, Nitrogen, Distribution, Kinetics, Nutrient requirements, Zooplankton, Continental shelf, Ceratium, Biochemistry, Euphotic zone, Light intensity, Physical properties, Bacteria, Pelagic zone, Copepods, Biomass.

Biological processes were important in rapid ammonia regeneration and recycling in the euphotic zone during a Ceratium tripos bloom in the New York Bight, April-May 1976. Inshore phytoplankton communities, typically located at depths > 25 m, are characterized by ammonia (NH4) and nitrate (N03) uptake rates that are less light-dependent than those of more uniformly distributed communities at the shelf break. Ammonia utilization, as a percentage of NH4 plus N03 utilization, yields values of 59% inshore and 70% at the shelf break. Inshore zooplankton have a 1.0 g/sq m mean dry weight whereas near the shelf break copepods have a 7.6 g dwt/sq m mean biomass. Greater zooplankton biomass at the shelf break compared to inshore regions corresponds to increased NH4 utilization by phytoplankton. Estimated NH4 re-

generation rates of inshore and shelf break zooplankton are 0.6 and 6.4 mmol N/sq m d, respectively. Observed NH4 utilization rates are 7.7 inshore and 10.3 mmol N/sq m d at the shelf break. In inshore water, benthic regeneration provides an additional 1.6 mmol N/sq m d and bacterioplankton, 0.65-1.85 mmol N/sq m d. Combined inshore NH4 input provides 38-53% of phytoplankton utilization potential whereas shelf break zooplankton NH4 input alone provides 62% daily regenerated production. Surface ambient NH4 and N03 concentrations are 0.4 and 0.1 micro mol/l, respectively; however, at 25-50 m depths concentrations are 2 and 4 micro mol/l, respectively. The New York Bight is bounded by Long Island on the north, New Jersey on the west and the 100 fathom contour line seaward. (Danovich-Wisconsin)
W80-04274

INFLUENCE OF AMAZON RIVER DISCHARGE ON THE MARINE PRODUCTION SYSTEM OFF BARBADOS, WEST INDIES,
Bellairs Research Inst., St. James (Barbados).
R. Kidd, and F. Sander.
Journal of Marine Research, Vol 37, No 4, p 669-681, November 1979. 1 Fig, 3 Tab, 57 Ref.

Descriptors: *Salinity, *Barbados, West Indies, *Amazon River, *Primary productivity, *Marine microorganisms, Nutrients, Water chemistry, Plankton, Hydrography, Tropical regions, Zooplankton, Speciation, Seasonal, Diatoms, Nutrient transport, Currents(Water), Precipitation(Atmospheric), Discharge(Water), Copepods, Runoff.

Hydrographic, biochemical and biological evidence show that Amazon River discharge has a profound effect on primary production off Barbados, West Indies, monitored February 1975-March 1976. Lower salinities, 33.4 ppt as opposed to 35.4 ppt (winter), traditionally experienced every summer at Barbados is attributed chiefly to increased seasonal precipitation and subsequent increased runoff in the Amazon region. In the tropical Caribbean marine environment, production is restricted by lack of essential nutrients. Phosphate concentrations are statistically higher during summer (0.060 micro g-A/l) than winter (0.043 micro g-A/l). Phytoplankton counts clearly indicate higher average plant populations during summer than winter. Diatoms account for a larger percentage of phytoplankton during summer (79.60%) than winter (54.65%). Mean zooplankton dry weight and numbers are significantly higher in summer than in winter. Twenty copepod species previously unknown to Barbadian waters were recorded; 13 of these occurred in winter and only seven during summer. Lower diversity and sominance are associated with summer Amazon River 'freshened' waters in the region. Conversely, higher diversity and dominance are associated with winter, when Amazon River influence is minimal. Lower salinity waters, associated with maximum Amazon River discharge, increase physiological stress to the otherwise biologically-accommodated stenotopic regional fauna. This favors eurytopic pelagic fauna, reducing species diversity and giving rise to lower dominance diversity. (Danovich-Wisconsin)
W80-04275

CHANGES IN PHOSPHORUS CONCENTRATION IN A EUTROPHIC LAKE AS A RESULT OF MACROPHYTE-KILL FOLLOWING HERBICIDE APPLICATION,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
M. T. Michaud, G. J. Atchison, A. W. McIntosh, R. A. Mayes, and D. W. Nelson.
Hydrobilogia, Vol 66, No 2, p 105-111, October 1979. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Aquatic weed control, *Palestine Lake(IN), *Eutrophication, *Phosphorus, *Diquat, Water pollution effects, Lakes, Shallow water, Potamogeton crispus, Ceratophyllum demersum, Lemna minor, Aphanizomenon flos-aque, Seasonal, Algicides, Macrophytes, Sediments, Water quality, Herbicides, Pondweeds.

Only a relatively small and short-term increase in phosphorus concentration occurred in Lake Palestine, Indiana, shortly after P. crispus die-off resulting from herbicide application in May 1976. Phosphorus concentrations in shallow water sediments decrease during summer; those in deep water sediments increase. Although large increases in phosphorus concentration occurred in late summer, it was not attributed to diquat. Palestine Lake, a small 93-ha highly eutrophic lake located in north central Indiana, has two basins connected by a channel; each consists of a small deep area (7-10 m) that stratifies in summer and a large relatively shallow area that completely circulates. In May 1976 diquat was applied to shallow water areas to control Potamogeton crispus which infests the lake during spring and early summer. Large numbers of Lemna minor (duckweed) appeared within a week after herbicide application; subsequent extensive reduction of macrophyte populations occurred. Three weeks after the application L. minor had decreased, and large stands of Ceratophyllum demersum (coontail) appeared. Increased numbers of L. minor were noted during late July, followed by a large bloom of Aphanizomenon flos-aque in August. Between mid April and early August ten collections of water samples from 20-cm below water surface and 20-cm above sediment bottom at three different shallow water sites were made. In addition, water samples were taken from each of two deep water areas at 2-m intervals. (Harris-Wisconsin)
W80-04276

ISOLATION AND IDENTIFICATION OF PATHOGENIC NAEGLERIA FROM FLORIDA LAKES,
Epidemiology Research Center, Tampa, FL.
F. M. Wellings, P. T. Amuso, S. L. Chang, and A. L. Lewis.
Applied and Environmental Microbiology, Vol 34, No 6, p 661-667, December 1977. 2 Fig, 4 Tab, 10 Ref. EPA R-804375-010.

Descriptors: *Pathogenic bacteria, *Lakes, *Florida, *Freshwater, *Public health, Human pathology, Human diseases, Amoebic meningoencephalitis, Water temperature, Sampling, On-site data collections, Naegleria, Thermal pollution, Overwintering sites, Sediments, Lake sediments, Sediment-water interfaces, Cores.

Pathogenic Naegleria survive the winter in freshwater Florida lake bottom sediments, showing that thermal-discharge pollution of waters does not play a role in maintaining natural pathogenetic Naegleria. Thirty one freshwater lakes in Florida were sampled in 1976 to determine the presence of pathogenetic Naegleria, a causative agent of primary amoebic meningoencephalitis. Twelve of 26 lakes sampled only once yield the amoeba. Three of five lakes sampled routinely reach levels of one amoeba per 25 ml of water tested during hot summer months. As water temperatures decline, isolates are obtained only from lake bottom samples in water depths 7-25 feet. Only the upper 3 in of core sample yield isolates. Freshwater lake temperatures during November and December reach a high of 26C and a low of 16C. Due to the methodology used in collecting bottom samples, actual site of cyst survival is not known. Since all core sample isolations were made from the upper 3 in, survival sites appear to be in surface bottom sediments. Indirect fluorescent-antibody techniques show that the antigenic composition of pathogenetic and nonpathogenetic Naegleria exhibits grown differences. (Harris-Wisconsin)
W80-04277

A STUDY OF THE ROLE OF THE SEAGRASS POSIDONIA AUSTRALIS IN THE CARBON BUDGET OF AN ESTUARY,
Commonwealth Scientific and Industrial Research Organization, North Beach (Australia). Div. of Fisheries and Oceanography.
H. Kirkman, and D. D. Reid.
Aquatic Botany, Vol 7, No 2, p 173-183, October 1979. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Port Hacking(Australia), *Leaves, *Carbon cycle, *Estuarine environments, *Marine algae, *Inlets(Waterways), Standing crops, Plant growth, Growth rates, Organic matter, Grazing, Carbon, Regression analysis, Decomposing organic matter, Degradation(Decomposition), Herbivores, Estuaries, Biomass, Floating plants, Grassed waterways, Posidonia australis, Australia.

Estimated average leaf growth was 2.3 mg C/g dwt d for seagrass Posidonia australis in Port Hacking, Australia, April 1974-September 1975. Estimated losses were 2.6 mg C/g dwt d, of which 48% was dissolved organic carbon (DOC) while grazing by herbivores (3%), leaves floating off (12%) and sinking leaves (37%) accounted for the remaining carbonaceous material lost from seagrass leaves. In summer and autumn, herbivores graze at the rate of 0.08 mg C/g leaf d. A mean of 0.136 g/sq m d or 0.3 mg C/g d of floating seagrass leaves detachs from the seagrass bed; these amounts are only 0.004% per day of the total 500 sq m seagrass bed biomass. Mean accumulation rate of leaf material or sinking particulate organic carbon is 0.45 g/sq m d or 0.96 mg C/g d. DOC release rates by seagrass leaves range 0.744-1.752 mg C/g d; results include excreted material plus DOC given off by leaf decomposition. Leaf growth over the warmer months varies 2.4-2.8 mg C/g d, while for cooler months, figures range 1.4-1.8 mg C/g d. DOC accounts for the greatest organic carbon loss from the system. The study area is part of an estuarine sunken river valley with 18 m maximum depth; the valley is cut by wide, shallow sand sills which support seagrass beds. (Danovich-Wisconsin)
W80-04278

REFLECTANCE SPECTROSCOPY OF MARINE PHYTOPLANKTON. PART I. OPTICAL PROPERTIES AS RELATED TO AGE AND GROWTH RATE,
University of Southern California, Los Angeles. Dept. of Biological Sciences.
D. A. Kiefer, R. J. Olson, and W. H. Wilson.
Limnology and Oceanography, Vol 24, No 4, p 664-672, July 1979. 6 Fig, 2 Tab, 19 Ref. NOAA 04-6-158-44031 and 04-6-158-44033.

Descriptors: *Reflectance, *Marine algae, *Optical properties, *Age, *Growth rates, Cultures, Phytoplankton, Spectrometers, Absorption, Light, Thalassiosira, Monochrysis, Chrysophyta, Oceans, Color, Standing crops, Cytological studies, Chlorophyll, Pigments, Spectrophotometry.

Diffuse spectral transmittance and reflectance measurements from suspensions of diatom Thalassiosira pseudonana (batch cultures) and chrysophyte Monochrysis lutheri (continuous cultures) contain information relating not only to cell concentrations but also to cell age and growth rates. Measurements yield values for the diffuse absorption coefficient, A, and diffuse backscattering coefficient, B, two parameters used to calculate effects of phytoplankton crop size on ocean color spectra. In both experiments, the ratio of absorption coefficient to backscattering coefficient, A:B, decreases with decreasing growth rate or increasing culture age. In batch cultures the ratio A:B decreases with age once the plateau phase is reached; in continuous cultures, A:B is roughly proportional to specific cell growth rates. Thus, in steady state systems, phytoplankton absorption and scattering properties appear to be an index of the growth rate or nutritional state of a given species. In batch cultures, changes in A:B for 450 and 675 nm, corresponding to maximum blue and red absorption by cells, parallels changes in the ratio of cell chlorophyll-a to cell cross section. In the red region of chlorophyll-a absorption, the magnitude of both changes is comparable. Ratio of A:B decreases with increasing age; this is caused predominantly by the loss of photosynthetic pigments however, backscattering efficiency also increases significantly. Changes in A:B are larger at the red absorption maximum of chlorophyll-a than in the blue, where accessory pigments also contribute to the absorption coefficient. (See also W80-04280) (Danovich-Wisconsin)
W80-04279

REFLECTANCE SPECTROSCOPY OF MARINE PHYTOPLANKTON. PART 2. A SIMPLE MODEL OF OCEAN COLOR,

Scripps Institution of Oceanography, La Jolla, CA. Visibility Lab.
W. H. Wilson, and D. A. Kiefer.
Limnology and Oceanography, Vol 24, No 4, p 673-682, July 1979. 6 Fig, 18 Ref. NOAA 04-6-158-44031 and 04-6-158-44033.

Descriptors: *Color, *Phytoplankton, *Reflectance, *Optical properties, *Oceans, Light, Water properties, Absorption, Standing crops, Spectrometers, Growth rates, Age, Equations, Mathematical models, Mathematical studies, Physical properties, Cultures, Sargasso Sea, Diffusion, Atlantic Ocean.

A two-component (water and phytoplankton) model of ocean color is based on measurements of optical properties of phytoplankton grown in the laboratory; broad spectral changes in diffuse reflectance result not only from phytoplankton crop size but also from age or physiological state. The ratio of reflectances at two wavelengths, R (440 nm):R (550 nm), is graphed as a function of chlorophyll concentration for four spectra sets. The relationship between chlorophyll-a concentration and reflectance ratio at these two wavelengths is hyperbolic; reflectance ratios range from a high value, 6, for blue oligotrophic waters where phytoplankton contribute insignificantly to absorption and backscattering, to a low of 0.2 in yellow-green waters where phytoplankton contribute exclusively to total absorption and backscattering. At low chlorophyll concentrations when the ratio is large, it changes rapidly and at high concentrations it changes slowly. Since microscopic examinations of natural seawater generally reveal higher concentrations of brown and white detritus than living cells, older cells are probably more like detritus optically than faster growing cells. Ocean color spectra was compared with field optical measurements. Phytoplankton coefficients were determined from spectrophotometer measurements of cells grown in the laboratory; water coefficients were calculated from optical measurements made in Sargasso Sea oligotrophic waters. (See also W80-04279) (Danovich-Wisconsin)
W80-04280

INTERACTION (ALLELOPATHY) BETWEEN MARINE DIATOMS: THALASSIOSIRA PSEUDONANA AND PHAEODACTYLUM TRICORNUTUM,
Delaware Univ., Lewes. Coll. of Marine Studies.
J. H. Sharp, P. A. Underhill, and D. J. Hughes.
Journal of Phycology, Vol 15, No 4, p 353-362, December 1979. 8 Fig, 3 Tab, 39 Ref.

Descriptors: *Cultures, *Diatoms, *Allelopathy, *Competition, *Inhibition, Growth rates, Phytoplankton, Population, Density, Phaeodactylum, Thalassiosira, Cytological studies, Laboratory tests, Aquiculture, Hydrogen ion concentration, Nutrient requirements, Silicates, Marine algae, Nutrients.

Evidence from single and mixed culture experiments shows that Phaeodactylum tricornutum is capable of inhibiting Thalassiosira pseudonana growth and that the dominance of the former species in uncontrolled mass algal cultures may be partially due to this effect. In two species batch cultures T. pseudonana grows more rapidly than P. tricornutum during the exponential phase; subsequently P. tricornutum continues to grow and becomes more abundant, possibly due to allelophathy. Inhibitory effects are due to filterable chemicals put into the medium from dense stationary phase cultures; chemicals manifest both a lag prior to exponential phase and lower terminal T. pseudonana population densities. The inhibitory chemical appears to be heat labile in that autoclaving removes its effect. The influence of P. tricornutum on T. pseudonana may be partially due to inorganic additions (hydroxyl ions) to the medium. Differential silicate utilization is also a consideration since P. tricornutum lacks a silicate requirement for growth. Inhibition may also be caused by a vitamin B-12 binding factor. At high growth rates P. tricornutum washes out when added at low density, whereas T. pseudonana maintains constant cell density. However, when sufficient P. tricornutum densities are added as a contaminant, both species wash out. At lower growth rates, P. tricornutum increases in density when added and eventually reaches a stable population; T. pseudonana then washes out. (Danovich-Wisconsin)
W80-04281

DIURNAL OXYGEN RHYTHM AND PRIMARY PRODUCTION IN THE MIXED LAYER OF THE ATLANTIC OCEAN AT 20 DEGREES N,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5A.
W80-04282

DISSOLVED AND PARTICULATE ORGANIC CARBON IN THE NORTH EQUATORIAL CURRENT OF THE ATLANTIC OCEAN,
Nederlands Inst. voor Onderzoek der Zee, Texel.
H. Postma, and J. W. Rommets.
Netherlands Journal of Sea Research, Vol 13, No 1, p 85-98, October 1979. 6 Fig, 1 Tab, 15 Ref.

Descriptors: *Carbon cycle, *Atlantic Ocean, *North equatorial current, *Organic matter, *Cycling nutrients, *Primary productivity, Carbon, Surface waters, Carbon dioxide, Diurnal, Nutrients, Nutrient transport, Sinks, Salinity, Chemical properties, Environmental gradient, Upwelling, Mixing, Currents(Water), Water circulation.

In September-October 1977 and November 1978 a study of biological systems in the North Equatorial Current of the Atlantic Ocean, focusing on organic matter cycles in upper surface layers, indicated that POC decreased east to west from an average 100 microg/l to 35 microg/l. POC differences between a day and night are 70-20 microg/l, respectively. From these differences, primary production values of 450-1000 g C/sq m yr were calculated. These values are much higher than earlier data obtained by C14 measurements. Such high productivity in subtropical ocean areas is due to rapid chemical recycling by very small microplankton standing stocks. Chemical components measured also show distinct vertical gradients. DOC decreases with depth from 1 mg/l surface values to 0.5 mg/l at 500 m; carbon dioxide (C02) increases in the same direction, 2.05 mmol/l at the surface and 2.3 mmol/l at 500 m. DOC and C02 are inversely related with a 1:6 ratio. Downward DOC transport calculated from vertical gradients is 8 g/sq m yr. The highest POC concentrations (>100 microg/l) are found in surface waters; the lowest amounts (<20 microg/l) occur in deeper water. Salinity is highest in the upper layers, with values over 36 ppt, and decreases with depth. Upwelling occurs at some stations and is indicated by rising isohalines. A density discontinuity layer is present at 40-75 m. Below this discontinuity layer, a salinity maximum is found; the highest salinity is 37.2 ppt. The salinity maximum represents surface water from the north that has descended below the discontinuity layer and flows south. (Danovich-Wisconsin)
W80-04283

CURRENT C14 METHODS FOR MEASURING PRIMARY PRODUCTION: GROSS UNDERESTIMATES IN OCEANIC WATERS,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5A.
W80-04284

AN INVESTIGATION OF HETEROTROPHIC AND PHOTOHETEROTROPHIC CAPABILITIES IN MARINE PYRRHOPHYTA,
Harvard Univ., Cambridge. Biological Labs.
L. C. Morrill, and A. R. Loeblich, III.
Phycologia, Vol 18, No 4, December 1979, p 394-404. 6 Fig, 1 Tab, 44 Ref. NSF DEB 78 25621.

Descriptors: *Heterotrophy, *Pyrrhophyta, *Dinoflagellates, *Light, *Speciation, *Growth rates, *Nutrient requirements, Biochemistry, Photosynthesis, Cultures, Nitrogen, Organic compounds, Organic matter, Algae, Metabolism, Plant physiology, Plant growth, Substrates, Soils, Laboratory tests, Darkness, Marine algae.

Eight marine dinoflagellates were investigated for possible heterotrophic and photohetrotrophic growth on 54 organic substances; in all but two organisms, the highest or second highest growth rates under photosynthesis limiting conditions occurred with glycerol. Because glycerol concentrations used in experiments are high (54 mM) relative to organic carbon concentrations in seawater, it is doubtful that these compounds play a major role in trophic strategies of marine dinoflagellates. In some organisms in the presence of DCMU, soil extract allows higher growth rates than glycerol. Despite widespread capability of photoheterotrophic glycerol utilization, true heterotrophy does not occur among organisms tested in darkness. When Peridinium foliaceum is tested in glycerol, some cells continue to swim for as long as two weeks. Inability to grow on glycerol in the dark results from the inability to take up glycerol rapidly enough to provide sufficient energy to divide. Dinoflagellates are also sensitive to high glycerol concentrations; the maximum which P. foliaceum tolerates is 250 mM. High glycerol concentrations are inhibitory because of osmotic effects. Soil extracts do not support photoheterotrophic growth in any organism tested under dim light. Nitrogen limited cultures of P. foliaceum and free-living Zooxanthella microadriatica are capable of using soil extract as a nitrogen source. Other species tested include Cachonina niei, P. balticum, symbiotic Z. microadriatica, Amphidinium carterae, Fragilidium heterolobum and a second isolate of P. foliaceum. (Danovich-Wisconsin)
W80-04285

DESCRIPTIVE AND COMPARATIVE STUDIES OF MAINE LAKES,
Maine Univ. at Orono. Life Sciences and Agriculture Experiment Station.
For primary bibliographic entry see Field 2H.
W80-04286

INTEGRATION OF BIOLOGICAL WITH THERMAL CRITERIA FOR POWER PLANT DESIGN AND WATER RESOURCE USE,
Wisconsin Univ.-Madison. Lab. of Limnology.
J. J. Magnuson, P. A. Medvick, G. W. Gallepp, R. J. Hall, and P. W. Rasmussen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-166440, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Completion Report 80-02, 1979. 52 p, 13 Fig, 3 Tab, 26 Ref. OWRT B-092-WIS(1), 14-31-0001-5133.

Descriptors: *Sunfishes, Freshwater fish, Fish behavior, Food habits, Fish diets, Fish parasites, *Fish populations, *Growth rates, *Heated water, Electric power plants, Cooling water, Water temperature, Lakes, Lake Monona(WI), Dane County(WI), Wisconsin, *Thermal power plants, Environmental effects, *Bluegill.

The energetic consequences of heated effluent from a 220 MW generating plant on the growth and production of bluegill in a 1400 ha eutrophic lake were analyzed. The heated effluent altered temperatures of 1-2% of the lake surface area or 2.6% of its littoral zone. Average temperatures in the outfall area did not exceed 30C. During summer an average of 6-7% of the bluegill in the lake were estimated to be in the outfall area. In winter bluegill released near the outfall tended to remain in the heated water and remained closer to shore than in other seasons. Growth of bluegill was compared between the outfall and reference area from measurements of fish held in each area in enclosures, and from growth simulation using a bioenergetic model for fish growth. Fish in cages usually grew more rapidly in the outfall, but simulated growth was slightly lower in the outfall area. A strong argument cannot be made for major effects of the heated effluent on growth. Based on the observed growth of caged fish and high population density in the outfall area, small bluegill in the littoral zone may have a 20% enhancement of production during summer. The results indicate that a small electric generating station in an urban area can use the local eutrophic lake as a source of once-through cooling water without negative effects on the growth and production of the dominant warmwater fishes. (Warner-Wis)

W80-04289

METHANE ADDITION TO AN ARCTIC LAKE IN WINTER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W80-04308

THE ACUTE TOXICITY OF ELEVEN DETERGENTS TO FISH: RESULTS OF AN INTERLABORATORY EXERCISE,
Shell Research Ltd., Sittingbourne (England). Toxicology Lab.
B. Reiff, R. Lloyd, M. J. How, D. Brown, and J. S. Alabaster.
Water Research, Vol 13, No 2, p 207-210, 1979. 4 Tab, 12 Ref.

Descriptors: *Toxicity, *Fish, *Detergents, *United Kingdom, *Germany, Toxins, Water quality, Water quality standards, Speciation, Testing, Testing procedures, Laboratory tests, Lethal limit, Pollutants, Water pollution effects, Water pollution, Fish types, Fish physiology, Brown trout.

Results from a 1973 interlaboratory ring test to assess acute toxicity of 11 detergents to fish in the United Kingdom and Germany demonstrate that a reliable order of magnitude for acute toxicity is obtained by a variety of test fish and procedures. The golden orfe (Idus idus melanotus) was tested in Germany and harlequin fish (Rasbora heteromorpha) and rainbow trout (Salmo gairdneri) were tested in the United Kingdom. German tests use only one standard method while the United Kingdom series employs six different methods. LC50 values for each detergent obtained by various methods and fish species are all within the same order of magnitude. When considering the average 48-h LC50 values, brown trout tends to yield lower values than other species and taken overall, the golden orfe and harlequin fish have approximately the same sensitivity towards detergents. Both German and U.K. tests rank detergents 10, 4, 1 and 6 as least toxic and detergents 5, 9 and 3 as most toxic. Acute toxicity tests cannot be used alone in setting water quality standards but only in conjunction with other data such as biological and chemical oxygen demand, biodegradability, compound amounts likely to reach surface waters, uptake and metabolism by aquatic organisms, longer lethal and sublethal effects, together with receiving water chemical and physical characteristics. Products resulting from biodegradation should also be tested for acute toxicity. (Danovich-Wisconsin)
W80-04341

THE INFLUENCE OF THICK FLOATING VEGETATION (WATER HYACINTH: EICHHORNIA CRASSIPES) ON THE PHYSICO-CHEMICAL ENVIRONMENT OF A FRESH WATER WETLAND,
Bhagalpur Univ. (India). Ecology Research Lab.
D. N. Rai, and J. D. Munshi.
Hydrobiologia, Vol 62, No 1, p 65-69, January 1979. 5 Fig, 1 Tab, 8 Ref.

Descriptors: *Bhathwa Pokhar, India, *Water hyacinth, *Wetlands, *Physicochemical properties, *Freshwater marshes, Swamps, Sewage disposal, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide, Seasonal, Environmental effects, Ecosystems, Ecology, Floating plants, Aquatic weeds, Aquatic plants, Diurnal, Water temperature.

Physiochemical measurements December 1976-August 1977 of Bhathwa Pokhar, a freshwater wetland at Darbhanga, India, showed that dissolved carbon dioxide was higher and that oxygen, pH and temperature fluctuations were lower under water hyacinth areas than in open water. The extent of difference depends on the time of day and season. Due to extreme hypercarbic and hypoxic conditions most vertebrates living in hyacinth infested areas are air breathers such as water snakes and turtles or supplemental air breathers such as frogs and air-breathing fish. High carbon dioxide and low oxygen concentrations are due to high anaerobic decomposing mat leaves and detritus, increased respiratory activities of organisms, and decreased photosynthetic rates caused by water hyacinth shadowing effects over the water surface. Oxygen is very low under water hyacinth mats (always less than 2 ppm) and during the summer oxygen levels are reduced to zero in both infested and uninfested water areas. Dissolved oxygen reaches its lowest value in late night hours (4 A.M.) and peaks in the afternoon; the maximum value is 7 ppm in clear areas during winter. Bhathwa Pokhar is a shallow (1.5 m mean depth), small (1.5 ha), swampy pond and 98% area is covered by water hyacinth. The source of pond water is Darbhange Medical College campus sewage. (Danovich-Wisconsin)
W80-04342

PHOSPHORUS IN A MODEL POND STUDY: I SEDIMENT SELECTION AND PREPARATION,
Science and Education Administration, Durant, OK. Water Quality Management Lab.
A. Olness, W. W. Troeger, G. D. Pardue, and R. R. Huckleberry.
Hydrobiologia, Vol 63, No 1, p 11-15, March 1979. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Soil chemistry, *Soil types, *Fertilizers, *Phosphorus, *Adsorption, *Sediments, Soil properties, Soil erosion, Soil texture, Soils, Nutrients, Phosphates, Erosion, Ponds, Water pollution sources, Nutrient removal, Fertilization, Chemical properties, Loam.

Test results on two surface soils with contrasting textures show that any soil fertilizer additions increase the equilibration concentrations of soil suspensions and that erosion of fertilized soil increases phosphorus concentrations in reservoirs; however, due to buffering the increase in equilibrium phosphorus concentrations is not proportional to fertilizer phosphorus additions. Transformations of adsorbed phosphorus to fixed or non-exchangeable forms occurs more rapidly in some soils and further reduces fertilization effects. Soils tested included San Saba clay and Bowie loam. San Saba soil contains three times as much clay (45%), six times as much total phosphorus (415 micro g/g), four times as much inorganic phosphorus (225 micro g/g) and over three times as much organic carbon (3.5%) compared with Bowie soil. Both have near-neutral pH. San Saba soil contains significant amounts of carbonate (4.2%) whereas Bowie soil is virtually carbonate free. Phosphorus adsorption limits obtained with Langmuir adsorption model are > 200 micro g/g and 50 micro g/g for San Saba and Bowie soils, respectively. Phosphorus adsorption is proportional to soil surface area and clay content. San Saba soil has a larger buffering capacity and browder buffering range than Bowie soil. Significant phosphate fixation takes place in clay soil but no fixation occurs in loam soil. (Danovich-Wisconsin)
W80-04343

DENITRIFICATION BY THE SESSILE MICROBIAL COMMUNITY OF A POLLUTED RIVER,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
T. Nakajima.
Hydrobiologia, Vol 66, No 1, p 57-64, September 1979. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Denitrification, *Sessile algae, *Tamagawa River, Japan, *Water pollution effects, Nitrogen, Sewage effluents, Microorganisms, Water pollution, Tracers, Water temperature, Municipal wastes, Gases, Laboratory tests, Ammonia, Bacteria, Nitrates, Nitrites, Rivers, Metabolism, Plant physiology.

Denitrification by the sessile microbial community in the Tamagawa River, Japan is demonstrated by data collected 1974-1977. Loss of total inorganic nitrogen (sum of ammonia-, nitrite-, and mitrate-nitrogen) was observed when river water was incubated with sessile microorganisms in an artificial stream. In very polluted water areas, the loss was 1 mg N/1/d. This loss is due to inorganic nitrogen assimilation by sessile microbes and denitrifying bacteria which numbered 10 million cells/sq cm. Denitrification is confirmed by using N15 as a tracer. Dinitrogen evolved from labeled nitrate for both sessile microbial communities taken from unpolluted and polluted areas, even though they were incubated with oxygenated river water. The denitrification rate by sessile microbial communities taken from a very polluted area is 8-16 mg N/sq m/d and rises to 74-230 mg N/sq m/d when water temperatures increase from 14 to 30C. The N2 Ar ratio of gases evolved from the river bed is higher than that of air, suggesting in-situ denitrification. The Tamagawa River is located in the southwest part of Tokyo and is heavily polluted with municipal sewage. (Danovich-Wisconsin)
W80-04345

DIVERSITY AND INDICATOR SPECIES AS MEASURES OF WATER POLLUTION IN A SUBARCTIC LAKE,
J. W. Moore.
Hydrobiologia, Vol 66, No 1, p 73-80, September 1979. 4 Fig, 36 Ref.

Descriptors: *Speciation, *Water pollution, *Population, *Heavy metals, *Great Slave Lake(Canada), *Bioindicators, Mine wastes, Mineral industry, Indicators, Benthic fauna, Subarctic, Yellowknife Bay(Canada), Pollutant identification, Environmental effects, Invertebrates, Chironomidae, Mollusks, Effluents, Waste water(Pollution), Density, Canada.

Diversity indices and indicator species are ineffective in monitoring heavy metal pollution in Yellowknife Bay, situated on the north shore of Great Slave Lake, Northwest Territories, Canada, June-September 1976; however, density estimates provide a better assessment of subarctic pollution. The density of benthic organisms averages 100 animals/sq m near the effluent discharge point. At 1.5 km east and south of the discharge point, density reaches 1,000 animals/sq m. A total of 25 benthic invertebrates species occur within the most heavily impacted zone (100 animals/sq m). Procladius denticulatus is most abundant (18-30%), followed by Heterotrissocladius changi (12-21%) and Pisidium casertanum (9-15%). In moderately polluted areas (100-1,000 animals/sq m), 25 species occur; 22 of these are also found in the most heavily polluted area. H. changi is most important (18-33%), followed by P. denticulatus (11-20%) and P. casertanum (4-11%). In minimally impacted areas (1,000 animals/sq m), 23 species are found; 18 of these also occur near the effluent discharge point. H. changi accounts for 11-29% of benthic community numbers. Results show that in subarctic areas, diversity index does not monitor water pollution. Total species numbers are similar in all three impact areas. Moreover, percentage contribution of dominant community species are comparable throughout the study area. Sediments near the mine discharge contain high heavy metal concentrations: arsenic (2,500 mg/kg dwt); mercury (500 micro g/kg); lead (850 mg/kg); copper (750 mg/kg) and zinc (950 mg/kg). (Danovich-Wisconsin)
W80-04346

DISTRIBUTION AND ABUNDANCE OF ATTACHED, LITTORAL ALGAE IN 21 LAKES AND STREAMS IN THE NORTHWEST TERRITORIES,
J. W. Moore.
Canadian Journal of Botany, Vol 57, No 6, p 568-577, March 1979. 4 Fig, 3 Tab, 46 Ref.

Descriptors: *Sessile algae, *Northwest territories(Canada), *Lakes, *Streams, *Baseline studies, Aquatic plants, Epilithic, Epiphytes, Yellowknife(Canada), Great Slave Lake(Canada), Great Bear Lake(Canada), On-site data collection, Algae, Plant populations, Distribution, Littoral, Sediments, Sands, Substrates, Density, Biomass, Canada.

Four types of sessile, littoral algae were collected from 18 lakes and three streams in an area directly north-northeast of Yellowknife, Canadian Northwest Territories. Collections of algae attached to

rocks (epilithic), sediments (epipelic), higher plants (epiphytic) and sand grains (epipsammic) were made during 1975-1976 to determine population species composition and density. Tabellaria flocculosa is dominant among epilithic and epipelic species, with maximum density of 50-250 million cu micro m/sq cm. Of secondary importance are Achnanthes minutissima, Navicula spp., and Nitzschia frustulum, at densities of 10-30 million cu micro m/sq cm. The only two common epiphytic taxa, A. minutissima and T. flocculosa, maintain populations of 100-130 million cu micro m/sq cm; the most common epipsammic species (Amphora ovalis, Fragilaria construens, Achnanthes minutissima and A. pinnata) reach maxima of 4 million cu micro m/sq cm. For all sessile algae studied, the growing season is June -October. All four algal types have unimodal growth, reaching maximum in either July or August. Growing season stops in mid-October with freezeover of lakes and rivers. All lake samples were collected from the shoreline in less than 1 m of water. Collections in the three streams were made in still-water pools midstream, also at less than 1 m depth. (Harris-Wisconsin)
W80-04347

SALINITY INFLUENCE ON THE ECOLOGY OF PHYTOFLAGELLATE BLOOMS IN LOWER NEW YORK BAY AND ADJACENT WATERS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
J. B. Mahoney, and J. J. A. McLaughlin.
Journal of Experimental Marine Biology and Ecology, Vol 37, No 3, p 213-223, March 1979. 2 Fig, 1 Tab, 16 Ref. EPA R 803370030.

Descriptors: *Saline water-freshwater interfaces, *New York Bright, *Salt tolerance, *Marine algae, Estuaries, Saline water intrusion, Estuarine environments, Eutrophication, Olisthodiscus luteus, Massartia rotundata, Prorocentrum micans, Dinoflagellates, Phytoflagellates, Stress, Stress analysis, Laboratory tests, Cultures, Ecology, Growth rates, Salinity, *Lower New York Bay.

Salinity tolerances of phytoflagellates dominant in Lower New York Bay blooms are examined, with particular attention to possible river-ocean transition effects. Salinities in these waters range 15-32%. Cultures of Olisthodiscus luteus, Massartia rotundata and Prorocentrum micans were isolated and grown under laboratory simulation of change from brackish-river to ocean water salinities. Massartia grows well in the 20-33% salinity with optimum at 24-30%, and does not grow at salinities < 14% or > 40%. With preconditioning at 30%, the favorable salinity range shifts slightly higher (21-36%); but, optimum range is nearly the same. Lowest tolerated salinity is again 14% but growth is comparatively reduced up to 16%. Salinities higher than 40% permit growth. Olisthodiscus grows well in 6-42% salinity when preconditioned at 20%, and at 6-46% when preconditioned at 30%. Optimal ranges are wider and higher than for Massartia (10-36%) with no significant shift from inocula preconditioning. In higher salinities, growth of the two inocula is approximately the same except for 46%, at which only the 30% salinity inoculum grows. Prorocentrum preconditioned at 20% has good growth in 18-38% salinity, with optimum growth between 20-36% salinity; lower tolerance level is 6%. Preconditioning at 30% causes this species to grow well at salinities of 20% and higher, but the optimum range shifts to 27-46%, and the lower tolerance limit is high at 10%. Independent of culture preconditioning, optimum salinities are 27-36%. It is speculated that salinity stress may temporarily affect development of Massartia and Olisthodiscus blooms. (Harris-Wisconsin)
W80-04351

ABUNDANCE, POPULATION DYNAMICS AND PRODUCTION OF ZOOBENTHOS IN LAKE MYVATN, ICELAND,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
C. Lindegaard, and P. M. Jonasson.
Oikos, Vol 32, No 1-2, p 202-227, 1979. 13 Fig, 24 Tab, 41 Ref.

Descriptors: *Lake Myvatn(Iceland), *Baseline studies, *Benthic fauna, *Secondary productivity, Iceland, Aquatic microorganisms, Benthic flora, Tanytarsus gracilentus holmgren, Chironomus islandicus keiffer, Tubifex tubifex muller, Sampling, Food chains, Subarctic, Lakes, Polar regions, Cold regions.

Lake Myvatn is a large (38 sq km), shallow (maximal depth 4 m) northeastern Icelandic lake with an irregular shoreline and some 30 islands. The macrozoobenthos was sampled from depths of 1.5 and 4 m at six stations during 1972-1974, and at one station during 1975-1976. The sampling has produced evidence of 20 macrozoobenthic species. The macrozoobenthic distribution averages 64,500 individuals/sq m. Three species are the most common: Tanytarsus gracilentus Holmgren (79.4%), Chironomus islandicus Keiffer (9.3%), and Tubifex tubifex Muller (7.2%). The relative abundances of T. gracilentus and C. islandicus can be explained in terms of their respective annual life-cycles. T. gracilentus has two generations in one year and therefore it is more common than C. islandicus which has a two year life-cycle. During 1972-1974, the mean annual production of the total benthos community was 28.4 g/sq m, or about 1,000 tons ash free dry weight for the whole lake. T. gracilentus, C. islandicus, and T. tubifex contribute 67.1%, 23.6%, and 2.7% respectively, to total benthos production. Large annual fluctuations in production occurred during 1972-1974. These were traced to fluctuations of C. islandicus and T. gracilentus. In 1975-1976, both species disappeared from the only station where the sampling was conducted during that period. It is not certain if their disappearance is applicable to the whole lake. (Harris-Wisconsin)
W80-04352

NOTES ON THE GROWTH AND SPORULATION OF A NATURAL POPULATION OF APHANIZOMENON FLOS-AQUAE,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
R. I. Jones.
Hydrobiologia, Vol 62, No 1, p 55-58, January 1979. 1 Fig, 16 Ref.

Descriptors: *Cyanophyta, *Lough Neagh(Northern Ireland), *Spores, *Germination, *Life history studies, Phytoplankton, Algae, Eutrophication, Population, Population dynamics, Nitrates, Nitrogen, Hydrogen ion concentration, Density, Growth rates, Nutrients, On-site investigations, Northern Ireland.

Observed Aphanizomenon flos-aquae sporulation in 1973 in Kinnego Bay, a highly eutrophic part of Lough Neagh, North Ireland, was probably induced by high pH values caused by dense phytoplankton crops; other measured environmental factors were favorable to Aphanizomenon growth at this time. Aphanizomenon growth was observed in 1973-1974. Sporulation activity occurred only in June, 1973. Exponential growth continued well after sporulation and two secondary growths produced smaller populations than the first, but akinete production was not observed. Akinete production was not observed in 1974; Aphanizomenon growth was slight due to unfavorable conditions for nitrogen-fixing blue-green algae. Algal growth is related to dissolved nitrate-nitrogen in the water. Surficial algal accumulations were not observed in Kinnego Bay; the shallow (mean depth 2.1 m) water column is well mixed at all times. However, in June 1973, Aphanizomenon population density was the highest recorded (8.6 cu mm/l or 7,600 filaments/ml). High densities of photosynthesizing algae can greatly deplete dissolved carbon dioxide levels, leading to high pH values. When akinetes were produced, pH was 9.33-9.61. (Danovich-Wisconsin)
W80-04353

THE LAKE MYVATN ECOSYSTEM, ICELAND,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
P. M. Jonasson.
Oikos, Vol 32, No 1-2, p 289-305, 1979. 5 Fig, 8 Tab, 70 Ref.

Descriptors: *Lake Myvatn(Iceland), *Reviews, *Baseline studies, *Water quality, Iceland, Bibliographies, Subarctic, Lakes, Polar regions, Cold regions, Water temperature, Trophic level, Lake morphometry, Shallow water, Solar radiation, Rainfall intensity, Primary productivity, Diatoms, Phytoplankton, Benthos, Zooplankton.

The literature on the current physical, chemical, and biological conditions in Lake Myvatn is reviewed. Lake Myvatn, a shallow productive subarctic lake in the northeastern part of Iceland, consists of two basins connected by a narrow stretch of water. The lake bottom contains a layer of diatoms several meters thick and partially covered by macrophytes in the northern basin, and by Cladophora aegagropila in the southern basin. The lake has a phytoplankton production of 118 g C/sq m/year in the southern basin, and 75 g C/sq m/year in the northern basin, which is unusually high for the latitude. Seasonal succession is unimodal. High production due to Anabaena flos-aque coincides with high solar radiation, high temperature and time of ice-break. At other seasons production is low despite considerable biomass of diatoms and chrysophyceans. Net production of benthic diatoms amounts to 2220 kcal/sq m/year. Calculated production of C. aegagropila is 500 kcal/sq m/year. Macroepiphytes and epiphytes are important in the northern basin. A living substratum of Cladophora and macrophytes stabilizes the sediment and acts as sieve for resuspended organic matter. Substrate type and zoobenthos abundance and production show close relationship. Benthic crustacea produce 10 kcal/sq m/year in both basins. Zooplankton produced 43 and 15 kcal/sq m/year in the southern and northern basins respectively. Fish produced 3 kcal/sq m/year, and ducks produced 0.5 kcal/sq m/year, thus suggesting that energy flow is mainly channeled through phytobenthos and zoobenthos. (Harris-Wisconsin)
W80-04354

THE RATES OF DRY MATTER AND NUTRIENT LOSS FROM DECOMPOSING POTAMOGETON PECTINATUS IN A BRACKISH SOUTH-TEMPERATE COASTAL LAKE,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
C. Howard-Williams, and B. R. Davies.
Freshwater Biology, Vol 9, No 1, p 13-21, February 1979. 3 Fig, 2 Tab, 36 Ref.

Descriptors: *Decomposing organic matter, *Ecology, *Submerged plants, *Lakes, *Swartvlei Lake(South Africa), Detritus, Potamogeton pectinatus, Sago pondweed, Aquatic microorganisms, Nitrogen, Phosphorus, Potassium, Food chains, Littoral areas, Benthos, Shallow water, Benthic flora, Benthic fauna, Macrophytes, Biodegradation, Degradation(Decomposition), South Africa.

The rate of decomposition of the macrophyte Potamogeton pectinatus was studied in Swartvlei, a brackish south-terperate African Lake, during summer 1976, to asscertain the role of macrophytes in lake systems. Fifty litter bags were filled with 15 g of Potamogeton shoots (dry weight) collected prior to shoot die-off. Litter bags allowed the passage of macroinvertebrates which may play an important role in the breakdown process. Bags were suspended just below the surface within the Potamogeton community in two series; one at 2 m depth and the other at 1 m depth. Five bags from each series were harvested at 7, 15, 30, 90, 128, and 158 days. Contents were dried and analyzed for ash, phosphorus, potassium and nitrogen. Overall decay follows an exponential curve. The rate constant is 0.0205 per day. After 158 days, less than 5% of the original dry weight remained in the litter bags of both shallow water and deep-water series. There was no difference in changes of ash, nitrogen, phosphorus and potassium percentages between shallow water and deep water samples. The original stock of ash, phosphorus and potassium was lost more rapidly than dry matter in initial decomposition stages due to leaching. Almost the entire stock of potassium and 60% of phosphorus was lost in the first seven days. However, at 90 days phosphorus levels in the decomposing detritus rose significantly. Nitrogen levels in detritus decomposed slowly throughout the first

90 days and then remained constant. The significance of the decomposition rate of P. Pectinatus is discussed in terms of the Swartvlei Lake ecology. (Harris-Wisconsin)
W80-04355

INORGANIC MINERAL NUTRIENT LEVEL STUDIES ON POTAMOGETON PECTINATUS L. AND ENTEROMORPHA PROLIFERA IN FORFAR LOCH, SCOTLAND,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
Y. B. Ho.
Hydrobiologia, Vol 62, No 1, p 7-15, January 1979. 2 Fig, 5 Tab, 40 Ref.

Descriptors: *Pondweeds, *Forfar Loch(Scotland), *Plant tissues, *Inorganic compounds, *Water chemistry, *Nutrients, Macrophytes, Aquatic plants, Plant physiology, Sodium, Chemical analysis, Biochemistry, Sewage effluents, Correlation analysis, Nitrogen, Phosphorus, Calcium, Potassium, Scotland.

Nutrient levels present in the pondweeds Potamogeton pectinatus and Enteromorpha prolifera during summer 1976 in Forfar Loch, Scotland were generally high, reflecting high nutrient levels in loch waters. Nutrient levels in both Potamogeton and Enteromorpha are well above critical concentrations, reaching averages of 50 mg dwt/g nitrogen (N) and 6 mg dwt/g phosphorus (P). Nutrient levels in Forfar Loch waters are not limiting even at the height of the growing season. Potamogeton tissue N positively correlates (r=0.805) with water inorganic N level; tissue P also correlates (r=0.941) with phosphate water contents. N levels in Enteromorpha do not correlate with N water contents; the same is true for P. Calcium (Ca) content in Potamogeton (r=-0.649) and Enteromorpha (r=-0.763) negatively correlates with loch water Ca levels, mainly due to Ca precipitation from water onto the plant surface during high photosynthetic activities coupled with high water pH levels. Potassium (K) levels in Enteromorpha negatively correlate (r=-0.439) with K levels in loch water. No correlation is detected for sodium (Na) in both Forfar plants. Overall N and P levels are high and similar; Potamogeton N levels vary 40.4-60.1 mg/g, P levels vary 4.62-8.09 mg/g, Enteromorpha N levels vary 49.4-52.6 mg/g, P levels vary 5.08-7.54 mg/g. Enteromorpha has greater ash content and Ca and Mg levels than Potamogeton, however, the reverse is true for K, Na, and Fe levels. Potamogeton has ten times more sodium than Enteromorpha. (Danovich-Wisconsin)
W80-04356

OUTDOOR ALGAL MASS CULTURES-II. PHOTOSYNTHETIC YIELD LIMITATIONS,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Water Research, Vol 13, No 2, p 119-136, 1979. 14 Fig, 1 Tab, 74 Ref. DOE EG-77-S-02-4151.

Descriptors: *Algae, *Cultures, *Photosynthesis, *Light intensity, *Growth rates, Biomass, Nutrients, Temperature, Limiting factors, Depth, Flow, Flow characteristics, Light, Primary productivity, Algal growth potential, Aquiculture, Curves, Equations, Mathematical models, Physics.

At best conversion efficiencies of total sunlight, theoretical models predict and actual data reveal that 30-40 g dwt/sq m d algal biomass in outdoor cultures can be obtained in the short-term. On a bioengineering basis, the major challenge is to design large-scale outdoor cultures so as to achieve maximum potential yields consistently as a function of available sunlight intensity. Consideration must be given not only to flow rate and depth which control light utilization efficiencies, but also to many other factors affecting algal growth such as mixing, temperature, nutrient supply, pH control, and predator control. Although algal growth rates increase with temperature, respiratory and other decay processes are also influenced. The net effect is that temperature is not nearly as important as sunlight in controlling productivity. Maximal algal yields attained in various locations with different species and growth systems consistently have been 30-40 g dwt/sq m d. Based on productivity curves, 30-40 g dwt/sq m d represents an upper limit in achievable productivity; this figure is also consistent with energy balance curves. Energy balance curves are based on the most liberal considerations including the Bush equation, no decay and no light inhibition. (Danovich-Wisconsin).
W80-04358

A STATISTICAL MODEL FOR SMALL LAKE WATER QUALITY MANAGEMENT,
De Paul Univ., Chicago, IL.
J. Ciecka, R. Fabian, and D. Merilatt.
Water Resources Bulletin, Vol 15, No 5, p 1318-1330, October 1979. 2 Fig, 2 Tab, 12 Ref, 1 Append.

Descriptors: *Eutrophication, *Lakes, *Vollenweider models, *Phosphorus, *Water quality, *Statistical models, Trophic level, Nutrients, Nutrient loading, Lake restoration, Statistics, Regulation, Water quality standards, Decision making, Curves, Equations, Illinois, Recreation, Priorities.

Statistical analysis based on an estimated discriminant function provides support for the hypothesis that Vollenweider models can be applied validly to relatively shallow, fast-flushing lakes. The statistical model extends the Vollenweider and Dillon results by associating each alternative phosphorus loading with a probability that a given lake can achieve or maintain noneutrophic status. Data were initially taken from 27 eutrophic Illinois lakes; the sample size was enlarged to include additional lakes from New York, New England and the Great Lakes states resulting in a sample of 195 lakes, 35 of which were noneutrophic. On the basis of minimal limnological information, together with knowledge of point and nonpoint phosphorus contributions and technological data on nutrient control, quantitative supply priorities can be developed. Application of the model to several Illinois lakes indicates a wide tolerance range for phosphorus intrusion, suggesting that uniform phosphorus standards are not a desirable approach for regulatory agencies to pursue. Maximization of net present expenditures on water quality requires an approach capable of utilizing information provided by Vollenweider's model. The discriminant function provides an important component in a complete cost-benefit analysis of small lake water quality management. The paper concludes with a comparison of the Vollenweider approach to that of Reckhow, who developed a function capable of predicting lake anoxic or oxic conditions; results of both approaches are complimentary. (Danovich-Wisconsin)
W80-04359

NITROGEN FIXATION IN A NITROGEN-LIMITED IMPOUNDMENT,
National Inst. for Water Research, Pretoria (South Africa).
P. J. Ashton.
Journal of the Water Pollution Control Federation, Vol 51, No 3, p 570-579, March 1979. 6 Fig, 1 Tab, 28 Ref.

Descriptors: *Nitrogen fixation, *Impoundments, *Eutrophication, *Water quality control, *Rietvlei Dam(South Africa), Pretoria(South Africa), Nitrogen cycle, South Africa, Reservoirs, Cyanophyta, Anabaena circinalis, Microcystis aeriginosa, Monitoring, Potable water, Kempton Park(South Africa), Phosphorus, Trophic level, Waste water(Pollution), Water pollution effects, Algae, Limiting factors, Eutrophication, Algal blooms.

Water temperature is the major factor regulating the duration of algal blooms. Rietvlei Dam, a warm monomictic lake near Pretoria, South Africa. The dam is a source of potable water for Pretoria and is highly eutrophic; Rietvlei receives secondary treated domestic and industrial wastewater effluents by way of the lake's main feeder stream. The study was initiated October 1975 when a large bloom of Anabaena circinalis Rabenhorst, a heterocystous nitrogen-fixing blue-green alga, occurred in the impoundments. On the basis of two 12-hr field studies and routine monitoring, the total amount of nitrogen fixed by the bloom of A. circinalis October 22 - December 17, 1975 is estimated at 1.13 metric tons. On an annual basis, nitrogen fixed by this alga is approximately equivalent to 19.4% of the loading from the feeder stream. A large portion of the fixed nitrogen is released after the death of the Anabaena cells and becomes available to other species, notable Microcystis aeriginosa. The magnitude of algal blooms of species other than A. circinalis in Rietvlei Dam depends on the supply of available nitrogen in the water phase, inasmuch as this is the primary growth limiting nutrient. Control of the phosphorus in put is considered a key factor to prevent algal growth problems in Rietvlei. (Harris-Wisconsin)
W80-04360

THE SEASONAL CYCLE OF THE PHYTOPLANKTON IN THE COASTAL WATERS OF GHANA,
Fisheries Research Unit, Tema (Ghana).
E. R. Anang.
Hydrobiologia, Vol 62, No 1, p 33-45, January 8, 1979. 13 Fig, 39 Ref.

Descriptors: *Ghana, *Seasonal, *Upwelling, *Phytoplankton, *Tropical regions, *Population dynamics, Marine algae, Atlantic Ocean, Littoral, Diatoms, Water temperature, Salinity, Nitrates, Phosphates, Silicates, Cycling nutrients, Nutrients, Correlation analysis, Coasts, Population, Physicochemical properties.

A study was made to determine seasonal changes in quality and quantity of Ghana offshore phytoplankton population and to relate such changes to physico-chemical factors such as temperature, salinity, and nutrients. Phytoplankton peak numbers correlate well with low nutrient levels during upwelling, with an inverse relationship during other times. Nutrient release takes place rapidly with disappearance of the bloom. Ghana, with a subequatorial climate, experiences major upwelling in coastal Atlantic waters in July-October and minor upwelling in December-January. The major upwelling season is characterized by lowest surface water temperatures (<25C), highest salinity (>35%), and high nutrient concentrations. The minor upwelling period brings a small temperature decrease and an increase in salinity and nutrient concentration. Other times of the year are marked by high surface water temperatures, low salinity and low nutrient concentrations. Phytoplankton cell counts are also seasonal, with values greater than 1 million cells/l during major upwelling and a small increase during minor upwelling. Dinoflagellates almost disappear during both upwelling periods. Diatoms dominate most of the year and constitute more than 90% of the phytoplankton cell counts during major upwelling. Cell numbers and concentrations of nitrate, phosphate and silicate fluctuate, especially during upwelling. (Harris-Wisconsin)
W80-04361

OCCURRENCE OF NITRIC AND NITROUS OXIDES IN A COASTAL MARINE SEDIMENT,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
For primary bibliographic entry see Field 2K.
W80-04362

DYNAMICS AND SUCCESSION OF THE PHYTOPLANKTON IN A TROPICAL LAKE: LAKE LANAO, PHILLIPINES,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic Biology.
W. M. Lewis, Jr.
The Journal of Ecology, Vol 66, No 3, p 849-880, November 1978. 12 Fig, 2 Tab, 57 Ref. NSF GB 16054 and GB 41293.

Descriptors: *Phytoplankton, *Succession, *Plant populations, *Environmental gradient, *Lake Lanao(Philippines), Biomass, Nutrient requirements, Tropical regions, Temperate, Cyanophyta, Dinoflagellates, Aquatic microorganisms, Grazing, Light intensity, Sinking rate, Diatoms, Cryptomonads, Algae, Philippines.

At tropical lake Lanao, Philippines, analysis of growth fluctuations and growth correlations in the major phytoplankton classes provides evidence that the niche space divides in response to nutrient and light availability. Weekly abundance measurements were made of 70 phytoplankton species August, 1970- October, 1971. Maximal growth in diatoms and cryptomondas occurs during low light and high nutrient availability. Growth maxima for green algae, blue-green algae and dinoflagellates occur successively toward the high light and low nutrient end of the spectrum. Placement of species in terms of their growth responding to light availability and nutrient availability gradients creates a taxonomic pattern similiar to that observed in the class-level analysis of succession. Grazing rate and sinking rate of cells are the measurable factors governing loss of autotroph mass. Individual phytoplankton species separate better on the basis of different sinking rates. Diatoms and cryptomonads prefer high turbulence. Blue-green algae and dynoflagellates do not thrive in minimal turbulence, and green algae occupy middle range of conditions. In contrast to temperage lakes, phytoplankton succession in Lake Lanao consists of a series of numerous episodes initiated by abrupt changes in abiotic factors. However, events within any given episode bear resemblance to intra-episode events in temperate lakes. (Harris-Wisconsin)
W80-04363

LAKE MACROPHYTES AS THE FOOD OF ROACH (RUTILUS RUTILUS L.) AND RUDD (SCARDINIUS ERYTHROPHTHALMUS L.) I. SPECIES COMPOSITION AND DOMINANCE RELATIONS IN THE LAKE AND FOOD,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
A. Prejs, and H. Jackowska.
Ekologia Polska, Vol 26, No 3, p 429-438, 1978. 7 Tab, 4 Ref.

Descriptors: *Submerged plants, *Masurian Lakes(Poland), *Fish diets, Rooted aquatic plants, Roach fish, Rudd fish, Lake Beldany(Poland), Lake Warniak(Poland), Lake Mikolajskie(Poland), Fish food organisms, Elodea canadensis, Characeae, Ceratophyllum demersum, Potamogeton pectinantus, Potamogeton lucens, Batrachium circinatum, Macrophytes, Size, Poland.

Submerged macrophyte food contributions to different sizes of two fish species were investigated in three eutrophic lakes in the Masuria district of northern Poland. Macrophytes in roach fish diets do not exceed 35% of total food weight in lakes Beldany and Mikolajskie but achieve 90% in roach from Lake Warniak. The percentage of macrophytes in rudd fish diets vary with fish size; it does not exceed 15% for individuals less than 7 cm body length, whereas it reaches 85-99% of total food weight for individuals longer than 16 cm. In the macrophytes eaten by the roach, Elodea canadensis dominates. Characeae and Certophyllum demersum are also important in Lake Mikolajskie roach, and C. demersum and Potamogeton pectinatus in Lake Warniak roach. E. Canadensis dominates in rudd diets from lakes Mikolajskie and Warniak, whereas C. demersum and E. canadensis dominate in the macrophyte eaten by Lake Beldany rudd. No essential differences occur in composition and dominance structure of macrophytes consumed by different size classes of fish. Similarly, the number of macrophyte species found in guts of different size fish do not vary. In each intenstine, macrophyte fragments represent an average of 2-3 species. Both fish species use most submerged macrophytes as food when the latter are found in sufficiently high densities. However, some relatively abundant macrophytes (P. lucens, Batrachium circinatum) are not eaten. (Harris-Wisconsin)
W80-04364

GROWTH RESPONSES OF SELECTED FRESHWATER ALGAE TO TRACE ELEMENTS AND SCRUBBER ASH SLURRY GENERATED BY COAL-FIRED POWER PLANTS,
Iowa State Univ., Ames. Dept. of Botany.
R. W. Vocke, K. L. Sears, J. J. O'Toole, and R. B. Wildman.
Water Research, Vol 14, p 141-150, 1980. 8 Tab, 67 Ref.

Descriptors: *Aquatic algae, *Growth rates, *Industrial wastes, *Inhibition, Bioassay, Trace elements, Powerplants, Coals, Fossil fuels, Arsenic compounds, Cadmium, Mercury, Scenedesmus, Toxicity, *Coal powerplants, *Ash, *Arsenic, *Selenium.

In laboratory studies, the freshwater algae Ankistrodesmus falcatus, Scenedesmus obliquus, Selenastrum capricornutum, and Microcoleus vaginatus were exposed to potential pollutants from coal-fired power plants, and their growth responses were evaluated. Using a modification of the EPA Algal Assay Procedure Bottle Test, algae were incubated in media containing As(V) as Na2HAs04.7H20, Cd(II) as CdS04, Hg(II) as HgS04, Se(VI) as Na2Se04, in solution, and scrubber ash slurry generated at a western U.S. coal-fired power plant complex. First significant inhibition levels as well as algistatic-algicidal levels are reported. The median effective concentration (EC50) values for the potential pollutants ranged from 0.048-30.761 mg/l (0.00064-0.41058M) As(V), 0.005-0.019 mg/l (0.00004-0.00017 M) Cd(II), 0.033-0.253 mg/l (0.00016-0.00126 M) Hg(II), 0.033-8.511 mg/l (0.00042-0.10779 M) Se(VI), and 3.048-15.417% scrubber ash slurry extract (SASE). (Deal-EIS)
W80-04386

RESPONSE OF THE TENCH (TINCA TINCA L.) TO POTASSIUM NITRATE ENRICHED WATER,
Lyon-1 Univ., Villeurbanne (France). Lab. de Physiologie Generale et Comparee.
For primary bibliographic entry see Field 5B.
W80-04387

THE FLAX POND ECOSYSTEM STUDY: EXCHANGES OF INORGANIC NITROGEN BETWEEN AN ESTUARINE MARSH AND LONG ISLAND SOUND,
Marine Biological Lab., Woods Hole, MA.
For primary bibliographic entry see Field 2L.
W80-04389

EFFECTS OF TRACE METALS ON GROWTH OF YELLOW PERCH (PERCA FLAVESCENS) AS MEASURED BY RNA-DNA RATIOS,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
P. K. Kearns, and G. J. Atchison.
Environmental Biology of Fish, Vol 4, No 4, p 383-387, 1979. 1 Fig, 1 Tab, 33 Ref.

Descriptors: *Toxicity, *Zinc, *Cadmium, *Yellow Perch, Growth rates, Fish physiology, Absorption, Seasonal, Growth stages, Heavy metals, Mode of action, Biochemistry, *DNA, *RNA.

Relationships between sublethal concentrations of cadmium and zinc in natural water and metal uptake by and growth of fish were investigated. RNA-DNA ratios and weight gain were used to assess seasonal growth differences between yellow perch populations from contaminated and control sites. Whole-body concentrations of cadmium and zinc in young-of-the-year perch were significantly different between sites. Measurable growth differences did occur and were significantly correlated with cadmium levels. Growth differences that were prominent during mid-summer were reduced by late summer. RNA-DNA ratios were sensitive indicators of fish growth. (Deal-EIS)
W80-04390

POPULATION STRUCTURE AND SPECIES COMPOSITION OF THE FREE-LIVING NEMATODES INHABITING SANDS OF THE NEW YORK BIGHT APEX,
City Coll., New York. Dept. of Biology.
J. H. Tietjen.
Estuarine and Coastal Marine Science, Vol 10, p 61-73, 1980. 3 Fig, 6 Tab, 23 Ref.

Descriptors: *Animal populations, *Nematodes, *Habitats, Spatial distribution, Bottom sediments, Heavy metals, Sands, Coarse sediments, Particle size, Chromium, Copper, Lead, Zinc, Municipal wastes, New York Bight, *Species diversity.

The free-living nematodes inhabiting silty and medium to coarse sands at nine stations in the New York Bight Apex were studied from August 1973 to September 1974. Average population densities ranged from 221 to 1381; no significant differences in density associated with sediment type, organic carbon or heavy metal concentrations were observed. In medium sands with low organic carbon and low heavy metal concentrations the nematode fauna was characterized by: (1) dominance by members of the families Chromadoridae and Desmodoridae; (2), low relative abundance of the family Comesomatidae; and (3), high species diversity. In silty sands, and also in medium sands with high organic carbon and/or high heavy metal concentrations, the fauna was marked by: (1) low relative abundances of the Chromadoridae and Desmodoridae; (2), high dominance of the Comesomatidae; and (3), low species diversity. In medium sands species diversity was significantly inversely correlated with increased concentrations of Cr, Cu, Pb and Zn. However, no such relationship existed in silty sands. Contaminated medium sands were also marked by high relative abundances of the comesomatid Sabatieria pulchra, which may be able to tolerate stressed sands much better than the normal inhabitants of such sediments; species belonging to the families Chromadoridae and Desmodoridae. (Deal-EIS)
W80-04391

SODIUM AND POTASSIUM IONS EFFECTS ON PHOSPHORUS TRANSPORT IN ALGAL CELLS,
EcolSciences Inc., South Bend, IN.
S. C. Mohleji, and F. H. Verhoff.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 110-125, 1980. 13 Fig, 1 Tab, 40 Ref.

Descriptors: *Aquatic algae, *Eutrophication, *Phosphorus, *Metabolism, Absorption, Sodium, Potassium, Ions, Membrane processes, Chemical reactions, Nutrients, Lakes, Cytological studies, Chlorophyta, Cyanophyta, *Selenastrum, *Microcystis.

Phosphorus is a substantive part of microbial biomass usually in stoichiometric limitation and thus is cited as the cause of eutrophication. However, microbial biomass is kinetic and not stoichiometric and thus any constituent that alters the rate of microbial nutrient uptake could alter the eutrophic state of a water body. This paper contains an investigation of the influence of sodium and potassium concentrations on phosphorus uptake in Selenastrum capricornutum and Microcystis aeruginosa. The phosphorus uptake rate by Selenastrum was found to be a function of time and of sodium and initial phosphorus concentrations. The P-uptake rate increased rapidly as Na+ increased from 0 to 4 mg/l, but slowly in the range 4 to 20 mg/l. K+ apparently decreased the P-uptake by Selenastrum. Compared to Selenastrum, Microcystis proved highly efficient in absorbing P and its absorption ability was not significantly affected by the presence of Na+ or K+. (Deal-EIS)
W80-04392

EFFECTS OF CHLOROBROMINATED AND CHLORINATED COOLING WATERS ON ESTUARINE ORGANISMS,
Academy of Natural Sciences of Philadelphia, Benedict, MD.
L. H. Liden, D. T. Burton, L. H. Bongers, and A. F. Holland.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 173-182, 1980. 5 Tab, 50 Ref.

Descriptors: *Cooling waters, *Chlorination, *Toxicity, *Estuarine environment, Halogens, Bromine, Food chains, Powerplants, Oysters, Clams, Mortality, Copepods, Bioassays, Respiration, Phytoplankton, Fish physiology, Atlantic Menhaden, *Spot, *Leiostomus.

Toxicities of chlorobrominated and chlorinated cooling waters to selected estuarine food-chain

organisms were investigated during an on-site power plant study. Survivals were similar among juvenile Atlantic menhaden (Brevoortia tyrannus) and spot (Leiostomus zanthurus) after exposures to BrCl- and Cl2-treated condenser effluents, Juvenile American oysters (Crassostrea virginica) and brackish water clams (Rangia cuneata) had no halogen-atributable mortalities after 15-day exposures. Similar survival reductions were recorded for copepods (Acartia tonsa) subjected to BrCl or Cl2 residuals (<0.100 mg/l) for 24 hours. Eductions in oxygen evolution (77 to 388%) and carbon-fixation (40 to 71%) rates and increased respiration rates (56 to 1,276%) of entrained phytoplankton were recorded from both chlorobrominated and chlorinated samples. BrCl and Cl2 residuals thus appear to have similar toxicities to estuarine organisms. (Deal-EIS)
W80-04393

DEVELOPMENT AND SURVIVAL OF EMBRYOS OF LAKE HERRING AT DIFFERENT CONSTANT OXYGEN CONCENTRATIONS AND TEMPERATURES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
L. T. Brooke, and P. J. Colby.
The Progressive Fish-Culturist, Vol 42, No 1, p 3-9, 1980. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Herrings, *Water temperature, *Dissolved oxygen, *Toxicity, Water chemistry, Growth rates, Mortality, Habitats, Hatching, Fry, Embryonic growth stage, Fish physiology, Freshwater fish, Lake Herring, Coregonus.

Eggs of lake herring (Coregonus artedii) were incubated in a continuous-flow system at four constant water temperatures (2-8C) and five dissolved oxygen (DO) concentrations (1-12 mg/l). In comparison with incubation time at 12 mg/l DO, time to median hatch was significantly longer at 2 mg/l at 6C (no hatch at 1 mg/l), at 3 mg/l or less at 4C, and at 4 mg/l or less at 2C. The time between hatching of the first and last eggs varied inversely with temperature. Mean total lengths of newly hatched fry were significantly shortened at 1 and 2 mg/l DO. At 6 and 8C, percent survival through hatching was greater than at 2 and 4C at DO of 4 mg/l or more, but fell to zero at 1 mg/l. The percentage of normal fry produced decreased noticeably below 4 mg/l DO. The optimum temperature for highest percentage survival of normal fry decreased directly with the level of dissolved oxygen. The temperatures at which the highest percentages of normal fry hatched from eggs incubated at DO concentrations of 4 or 8, 2, and 1 mg/l, were 6, 4, and 2C, respectively-indicating a decreasing DO demand by embryos incubated at the lower temperatures. Our findings supported a previously published hypothesis that DO concentrations below 4 mg/l can be adverse to survival and development of coregonid embryos in nature. (Deal-EIS)
W80-04394

A COMPARISON OF THE ACUTE TOXICITIES OF TEN HEAVY METALS TO PHYTOPLANKTON FROM SAANICH INLET, B.C., CANADA,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
J. T. Hollibaugh, D. L. R. Seibert, and W. H. Thomas.
Estuarine and Coastal Marine Science, Vol 10, p 93-105, 1980. 5 Fig, 2 Tab, 49 Ref.

Descriptors: *Heavy metals, *Toxicity, *Phytoplankton, Copper, Mercury, Lead, Cadmium, Zinc, Nickel, Chromium, Bioassay, Inhibition, Growth rates, Aquatic algae, *Selenium, *Arsenic, *Antimony, *Thalassiosira.

The acute toxicities of Cu, Hg, Pb, Cd, Zn, Ni, Cr, Se, Sb, and As to Saanich Inlet phytoplankton were determined in enrichment culture bioassays. The toxicity of ions of a single metal to natural assemblages of phytoplankton enriched with nitrate, phosphate, and silicate was assessed by measuring the inhibition of plant growth. Toxicity to Thalassiosira aestevalis isolated from a June phytoplankton population was determined in a medium made of glass-fiber filtered Saanich Inlet seawater enriched with nitrate phosphate, and silicate. The concentration of a metal causing inhibition of growth under these conditions ranged from about 30 nannoM Hg to >1000 nannoM, Se, Sb, Cr, and Ni. The growth-inhibiting concentration of a given metal was similar to both natural populations and the Thalassiosira culture. Shifts in the species composition relative to controls were observed when natural assemblages were exposed to toxic levels of metals. (Deal-EIS)
W80-04398

DIEL PATTERNS OF PHYTOPLANKTON PRODUCTIVITY AND EXTRACELLULAR RELEASE IN ULTRA-OLIGOTROPHIC LAKE TAHOE,
California Univ., Davis. Div. of Environmental Studies.
M. M. Tilzer, and A. J. Horne.
Internationale Revue der gesamten Hydrobiologie, Vol 64, No 2, p 157-176, 1979. 8 Fig, 6 Tab, 55 Ref. NSF-RANN GI-22 and ERS 74-22675.

Descriptors: *Lake Tahoe(CA-NV), *Diel migration, *Phytoplankton, *Biorhythms, Oligotrophy, Diatoms, Chrysophyta, Primary productivity, Photosynthesis, Thermal stratification, Mixing, Cytological studies, Vertical migration, California, Nevada.

Lake Tahoe, California, phytoplankton is dominated by diatoms and chrysophytes. Mixing and thermal stratification are the main factors influencing seasonal productivity. Due to a relatively small (1.6 times the lake area) infertile watershed, the average annual primary production rates of the entire trophogenic zone are 0.5-0.6 g C/cu m. Between April and September 1975 a series of measurements was taken at the lake in order to assess the diel periodicity of phytoplankton photosynthesis and of environmental factors that relate to algae. Photosynthesis in shallow waters is light-inhibited throughout the day. Photosynthetic rates per unit chlorophyll-a, shows consistent relationship to subsurface light within single 24-hour periods, but varies between dates of experiments. Photosynthesis in mixed water columns is depressed in the afternoon due to a reduction in the photosynthetic potential of algae. Since extracellular release averages between 7.8 and 17.2% of total production rates and shows little vertical differentiation, damage of algal cells by light can be excluded. Overnight respiratory losses comprises at least 30% of the carbon assimilated during the preceding day. Integral photosynthesis shows a logarithmic correlation with incident light. This correlation can be used to predict daily production rates from mid-day incubation with an error of less than 10%. (Harris-Wisconsin)
W80-04399

THE PROCESS OF FISH FAUNA RESTORATION IN THE RIVER PEK FOLLOWING THE CATASTROPHIC OUTBREAK OF GANGUE FROM THE COPPER MINES 'MAJDANPEK' IN YUGOSLAVIA,
Institute for Biological Research, Belgrade (Yugoslavia).
D. Jankovic.
Symposia Biologica Hungarica, Vol 19, p 141-149, 1979. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Mine wastes, *Toxicity, *Biological communities, *Rivers, Copper, Heavy metals, Spoil banks, Chemical wastes, Waste dumps, Fish migrations, Aquatic populations, Fish populations, Bioindicators, Growth rates, *Yugoslavia, River Pek, Sediments.

As a consequence of repeated tectonic disturbances, a breach of the ore gangue of a copper mine occurred in Serbia in January 1974. The ore gangue was discharged together with water into the River Pek (Danube area) destroying its entire ichthyofauna. Studies conducted for four years showed the process of river restoration and the gradual recovery of fishes immigrating from the unpolluted upper river sections, its tributaries and the river danube. Living conditions have been studied following the catastrophe observing the growth of fishes as well as the pollution of the river by saprobity indicators. (Deal-EIS)
W80-04400

EFFECT OF CERTAIN ORGANOCHLOR INSECTICIDES ON PRIMARY PRODUCTION IN A FRESHWATER POND,
North-Eastern Hill Univ., Shillong (India). Dept. of Zoology.
S. A. K. Nasar.
Progress in Water Technology, Vol 11, No 6, p 247-251, 1979. 1 Tab, 23 Ref.

Descriptors: *Pesticide toxicity, *Primary productivity, *Phytoplankton, Chlorinated hydrocarbon pesticides, Aldrin, Dieldrin, Endrin, Inhibition, Photosynthesis, Mode of action, Insecticides.

Experiments were conducted to assess the effects and degree of toxicity of certain widely used organochlor insecticides i.e. Aldrin, Dieldrin and Endrin, on primary production of phytoplankton. The insecticides Aldrin, Dieldrin and Endrin showed a retardation of primary production in phytoplankton of 37.9%, 25.0% and 14.8% over control at 0.5 ppm, 0.01 ppm and 1.0 ppm respectively. The primary production was found to be nil at 1.0 ppm, 0.1 ppm and 1.5 ppm concentration of Aldrin, Dieldrin and Endrin respectively. The results of the present investigation thus sound a note of warning that the insecticides should be used carefully in the field, keeping in mind high toxicity, inhibiting phytosynthesis effect and harmful cumulative effect on the primary productivity of the adjacent water bodies. (Deal-EIS)
W80-04401

THE EFFECTS OF INTERACTING SALINITY, CADMIUM, AND MERCURY ON POPULATION GROWTH OF AN ARCHIANNELID, DINOPHILUS GYROCILIATUS,
Oslo Univ. (Norway). Inst. of Marine Biology.
For primary bibliographic entry see Field 5A.
W80-04403

BEHAVIOURAL STUDIES ON MUSSELS UNDER CHANGING ENVIRONMENTAL CONDITIONS,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 5A.
W80-04404

INFLUENCE OF THERMAL CHALLENGE ON CONDITIONED FEEDING FORAYS OF JUVENILE RAINBOW TROUT,
Environmental Research Lab.-Duluth, MN.
B. H. Munson, J. H. McCormick, and H. L. Collins.
Transactions of the American Fisheries Society, Vol 109, p 116-121, 1980. 3 Fig, 15 Ref.

Descriptors: *Fish behavior, *Toxicity, *Water temperature, *Rainbow trout, Juvenile growth stage, Heated water, Thermal stress, Heat resistance, Mortality, Laboratory tests, *Acclimation.

Juvenile rainbow trout (Salmo gairdneri) conditioned to traverse a 2.4 m-long channel to receive a food reward were subjected to in-transit thermal challenges. Conditioning was to a criterion that required 80% of the fish to leave the 'home' area and reach the 'reward' area within 2 minutes of release. Challenges were at successive 3C increments above acclimation or the previous challenge temperature. Fish were first observed to delay their entrance into the intervening heated water at challenge temperatures of 12-15C above acclimation. At each increment above 12-15C over acclimation temperature, delay in transit increased: however, complete group inhibition was never achieved. Above their critical thermal maximum (CTM) the reward was achieved even at the expense of deaths among the achievers. Responses were the same whether fish were challenged individually or as groups. Fish exposed to their CTM without prior challenges at less stressful temperatures responded similarly to those receiving progressively greater challenges. (Deal-EIS)

W80-04405

EFFECT OF SOME PESTICIDES ON THE RHYTHMIC ADDUCTOR MUSCLE ACTIVITY OF FRESH-WATER MUSSEL LARVAE,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 5A.
W80-04406

MASSIVE FISH MORTALITIES CAUSED BY ALGAL BLOOMS IN EUTROPHIC ECOSYSTEMS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
J. Barica.
Symposia Biologica Hungarica, Vol 19, p 121-124, 1979. 1 Fig, 13 Ref.

Descriptors: *Eutrophication, *Fishkill, *Seasonal, Cyanophyta, Nutrients, Ammonia, Dissolved oxygen, Oxygen requirements, Growth rates, Rainbow trout, Trophic level, Canada, Blue green algae.

Development of noxious Cyanophyte blooms from high inputs of nutrients, their rapid die-off and lysis result in massive fish mortalities from oxygen depletion and high ammonia levels (summerkill). This phenomenon, representing the ultimate stage of the eutrophication process, causes seasonal large-scale catastrophes in the fisheries of many countries of the temperate and warm climatic zones. Findings of limnological research on Canadian prairie lakes over 1971-1977 are summarized with particular reference to the mechanism, ecological impact, prediction and prevention of the phenomnon. (Deal-EIS)
W80-04408

THE INFLUENCE OF SALINITY ON BEHAVIOUR AND OXYGEN UPTAKE OF THE HERMIT CRAB PAGURUS BERNHARDUS L.,
University Coll. of North Wales, Bangor. Marine Science Labs.
J. Davenport, P. M. C. F. Busschots, and D. F. Cawthorne.
Journal of the Marine Biological Association of the United Kingdom, Vol 60, p 127-134, 1980. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Crabs, *Salinity, *Oxygen requirements, Animal physiology, Animal metabolism, Toxicity, Water chemistry, Animal behavior, Habitats, Adaptation, Dissolved oxygen, *Pagurus, *Hermit crab, *Acclimation.

A survey of tidal pools on the shore of the Menai Strait showed that hermit crabs are largely confined to water of 25 o/ooS or more. Experiments showed that specimens of Pagurus bernhardus retreated into their shells when environmental salinity levels fell to 20.5-22.5 o/ooS. This critical range was independent of rate of salinity change. However, acclimation to water of 23.1 o/ooS for more than 2 weeks lowered this behavioural threshold to 15.5 o/ooS. In respirometric experiments, hermit crabs were found to be 'oxygen conformers' since oxygen consumption fell with declining oxygen tension, especially below 30% air saturation. Crabs which had retreated into their shells in water of 16.5 o/oo or less showed negligible oxygen uptake whereas those which had retreated whilst in full seawater showed substantial oxygen consumption. These observations suggest that hermit crabs not only retreat into their shells at low salinity, but also cease ventilating their branchial chambers. Pagurus was found to survive in oxygen free sea water for 7 h, yet survived in fresh water for less than 3 h. This suggests that the withdrawn hermit crab succumbs to haemolymph dilution rather than to oxygen lack at low salinities. (Deal-EIS)
W80-04412

EFFECT OF ORGANOPHOSPHATE INSECTICIDE 'OWADOFOS PLYNNY-50' (FENITROTHION) ON BIOELECTRIC CHANGES IN CARDIAC MUSCLE OF EEL, ANGUILLA ANGUILLA L.,
Institute of Ichthyology, Szczecin (Poland). Dept. of Fish Physiology.
J. Muzykiewicz.
Acta Ichthyologica et Piscatoria, Vol 8, No 2, p 77-89, 1978. 5 Fig, 2 Tab, 34 Ref.

Descriptors: *Pesticide toxicity, *Eels, *Animal physiology, Organophosphorus pesticides, Mode of action, Inhibition, Animal metabolism, Membrane processes, Mortality, Bioassay, Lethal limit, *Fenitrothion, *Cardiovascular system, *Electrophysiology.

The effect of an organophosphate insecticide 'Owadofos plynny-50' (Fenitrothion) is shown in eel as a progressive bradycardia, elongation of ventricular changes (Q-T), and of an autonomic depolarisation of excitation-generating centres (T-P). Intravenal application of catecholamines delays and moderates the ECG changes brought about by the insecticide. (Deal-EIS)
W80-04416

MERCURY IN WATER, ORGANISMS AND SEDIMENTS FROM A SECTION OF THE TURKISH MEDITERRANEAN COAST,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Sciences.
For primary bibliographic entry see Field 5B.
W80-04417

MORTALITY, GROWTH AND FECUNDITY OF TRANSPLANTED MUSSEL AND BARNACLE POPULATIONS NEAR A PULP MILL OUTFALL,
Fisheries and Marine Service, Vancouver (British Columbia).
R. S. S. Wu, and C. D. Levings.
Marine Pollution Bulletin, Vol 11, p 11-15, 1980. 6 Fig, 23 Ref.

Descriptors: *Mussels, *Toxicity, *Pulp wastes, Mortality, Growth rates, Fecundity, Industrial wastes, Animal growth, Reproduction, Chemical wastes, Canada, Pulp and paper industry, *Barnacles, *Balanus, *Mytilus.

The mortality, growth and fecundity of transplanted adult mussel (Mytilus edulis) and barnacle (Balanus glandula) populations near a kraft pulp mill outfall at Port Mellon, British Columbia, were determined. The results indicated that adults of both species were tolerant of bleached kraft pulp mill effluent and survived near the pulp mill outfall. However, the growth rates of both species were retarded when compared with those at the control station. The reproductive activities of the transplanted barnacles were also impaired. (Deal-EIS)
W80-04418

CHLORINATED HYDROCARBONS IN FISH-EATING BIRDS FROM THE GDANSK BAY, BALTIC SEA,
Morski Inst., Gdansk (Poland).
For primary bibliographic entry see Field 5B.
W80-04419

AN AQUATIC SAFETY ASSESSMENT ON LINEAR ALKYLBENZENE SULFONATE (LAS): CHRONIC EFFECTS ON FATHEAD MINNOWS,
Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
For primary bibliographic entry see Field 5A.
W80-04420

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE, AND TROPHIC RELATIONSHIPS OF THE BENTHIC INFAUNA OF THE NORTHEAST GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, and G. E. M. Matheke.
In: Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators. Vol 6: Biological Studies, p 1-256, December 1979. 19 Fig, 33 Tab, 99 Ref, 5 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil pollution, *Benthos, *Ecosystems, *Baseline studies, *Water pollution effects, Alaska, Resources development, Environmental effects, *Outer Continental Shelf, Northern Gulf of Alaska(NEGOA), Trophic interactions, Petroleum development.

The objectives of this study were: (1) a qualitative and quantitative inventory of benthic species within and adjacent to identified oil-lease sites in the northeast Gulf of Alaska (NEGOA), (2) a description of spatial and temporal distribution patterns of selected species in the designated study area, and (3) observations of biological interrelationships, specifically trophic interactions, between components of the benthic biota. Basic information on diversity of the fauna is available. Diversity appears to increase in areas where the sedimentation rate is reduced and the presence of sand and gravel substrates increase environmental heterogeneity. Numerical analysis of the benthic infauna delineated four major site groups. One of these site groups, the Inshore Group, consisted of sites with predominantly silt-clay sediments located on the continental shelf. Its fauna was dominated by deposit-feeding species which were also present at all other sites. An example is given on a diesel fuel spill resulting in oil becoming adsorbed on sediment particles with resultant mortality of many deposit feeders on sub-littoral muds. Bottom stability was altered with the death of these organisms, and a new complex of species became established in the altered substratum. It is suggested that oil-related mortality of deposit feeders could result in a changed near-bottom sedimentary regime with subsequent alteration of species composition. Development of monitoring programs based on species composition at selected sites is recommended. (Sinha-OEIS)
W80-04421

BASELINE STUDIES OF FISH AND SHELLFISH RESOURCES OF NORTON SOUND AND THE SOUTHEASTERN CHUKCHI SEA,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. J. Wolotira, Jr., T. M. Sample, and M. Morin, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 6: Biological Studies, p 258-572, December 1979. 139 Fig, 87 Tab, 36 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fish, *Shellfish, *Baseline studies, *Resources development, *Environmental effects, Oil pollution, Water pollution effects, Alaska, Distribution, *Outer Continental Shelf, Norton Sound, Chukchi Sea, Ecological distribution, Petroleum development.

Findings from an intensive six-week survey (September-October, 1976) of fish and shellfish fauna in Norton Sound, the southeastern Chukchi Sea, and adjacent waters are presented and a brief review of other pertinent information on the survey region is discussed. Results of the survey defined the distribution and centers of abundance of several fish, crab, and snail species within the survey region and period. In addition, standing stock estimates and species composition of demersal fauna by geographic subdivisions of the survey region were determined. Analyses of species associations show recurrent groupings of certain species and their regional distributions. Estimates of biological characteristics, including size and age composition, length-weight relationships, and growth characteristics are provided for dominant fish species and for several species of crabs and snails. Most species studied are found in highest relative abundance in shallow, warm-water regions and greatest density occurs in Norton Sound. Growth of most fish appears greatest in areas studied south of Bering Strait. Almost no fish species were encountered in either sufficient size or quantity to be considered as potential for commercial harvest. (Sinha-OEIS)
W80-04422

TROPHIC RELATIONSHIPS AMONG ICE INHABITING PHOCID SEALS AND FUNCTIONALLY RELATED MARINE MAMMALS,
Alaska Dept. of Fish and Game, Fairbanks.
L. F. Lowry, K. J. Frost, and J. J. Burns.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 6: Biological Studies, p 573-629, December 1979. 14 Fig, 8 Tab, 72 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Mammals, *Oil pollution, *Baseline studies, *Environmental effects, *Water pollution effects, Resources development, Ecosystems, Alaska, *Outer Continental Shelf, Beaufort Sea, Trophic relationships, Prey.

The trophic relationships of Beaufort Sea marine mammals, primarily ice-inhabiting seals, have been investigated since 1975. This report is an effort to synthesize the information collected since that time and make it available to resource managers for consideration during Environmental Impact Statement preparation and policy formulation. The main objective has been to develop an understanding of the trophic relationships of marine mammals and to assess the potential effects on marine mammals of changes in the trophic structure of the Beaufort Sea which may result from OCS exploration and development. Not only is it important to know the direct effects of hydrocarbons on critical prey species, but it is also necessary to evaluate temporal variations in prey sensitivity, critical times or areas for particular prey species and critical feeding periods for predator species. Pollutant levels high enough to cause large-scale die-offs of individuals will probably occur only on a very localized basis (except where oil or pollutants are trapped under the ice and transported long distances in a relatively unweathered state). The greatest concern may be with long-term sublethal low concentrations of pollutants which may affect locomotion, metabolism or reproduction and lead to substantial reduction of populations over several generations. These long-term reductions are of special concern in considering food availability to consumers. (Sinha-OEIS)
W80-04423

DEMERSAL FISH AND SHELLFISH ASSESSMENT IN SELECTED ESTUARY SYSTEMS OF KODIAK ISLAND,
Alaska Dept. of Fish and Game, Kodiak.
J. E. Blackburn.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 6: Biological Studies, p 727-852, December 1979. 7 Fig, 14 Tab, 21 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fish, *Shellfish, *Fisheries, *Estuaries, *Oil pollution, Water pollution effects, Environmental effects, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, Kodiak Island, Petroleum development, Demersal epifauna.

This study was designed to sample virtually all the habitats within Ugak, Kaiugnak and Alitak bays but principally it was addressed to the demersal epifauna that are vulnerable to capture by otter trawl, specifically, fish and crustacean shellfish. The demersal community is an important segment of the marine community in the Kodiak lease area. It is highly productive, supports a number of valuable fisheries and most of the species of this community have pelagic stages in their life history which would place them in a wide variety of habitats at different times during the year. The larval and early juvenile stages of many species are found in the near surface and nearshore zones where, it would seem, oil development impact would be most severe. Targeting studies upon these probably susceptible stages to the exclusion of other life history stages would be inappropriate. Similarly a premature decision as to which habitats (demersal or pelagic - nearshore) would be most susceptible to oil development impact would be inappropriate. The inescapable conclusion is that knowledge of the demersal community is very important to the process of locating sensitive areas and sensitive taxa. This study broadens the base of knowledge of the demersal community in the two bays, Ugak and Alitak. (Sinha-OEIS)
W80-04425

OIL SPILL VULNERABILITY, COASTAL MORPHOLOGY, AND SEDIMENTATION OF THE KODIAK ARCHIPELAGO,
South Carolina Univ., Columbia. Coastal Research Div.
M. O. Hayes, and C. H. Ruby.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 2: Physical Science Studies, p 1-155, December 1979. 32 Fig, 3 Tab, 54 Ref, 4 Append, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil spills, *Baseline studies, *Water pollution effects, *Morphology, Alaska, Sediment transport, Coasts, Environmental effects, Resources development, Cold regions, *Outer Continental Shelf, Kodiak Island, Oil Spill Vulnerability Index.

The Oil Spill Vulnerability Index, as it applies to the Kodiak Archipelago is presented. It is based partly on the longevity of potential oil spills within each of the subenvironments. Forty-seven base maps are listed and under each base map, the 10 subclasses of the Oil Spill Vulnerability Index are listed with the number of shoreline kilometers falling into each class for that base map. Using the vulnerability classification, it is possible to make a few generalizations regarding the Kodiak area and its reaction to potential oil spills. In general, the area is quite high risk. Unfortunately, the Kodiak system is very complex and the higher risk areas do not lend themselves well to being protected during a spill. In many instances, a low risk rock scarp will lie just seaward of a large embayment with high risk pure gravel beaches. The indented (fjord) character of the islands will act as 'oil traps' for floating oil. Oil will tend to be moved deeper into the fjords rather than to be flushed out. In general this will result in an oiling of increasingly sensitive environments, since higher risk, lower energy classes are located deeper in fjords and embayments. Additionally, there are long periods of relatively low wind and wave energy, especially during the summer. A spill during one of these periods could prove particularly devastating. (Sinha-OEIS)
W80-04426

DYNAMICS OF NEAR SHORE ICE,
Washington Univ., Seattle. Polar Science Center.
R. Colony.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 2: Physical Science Studies, p 156-180, December 1979. 5 Fig, Append, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil spills, *Ice, *Baseline studies, *Water pollution effects, Alaska, Environmental effects, Resources development, Cold regions, *Outer Continental Shelf, *Pack ice, Beaufort Sea, Chukchi Sea, Petroleum development, Nearshore.

The near shore pack ice of the Beaufort Sea and Chukchi Sea have a profound influence on the development of the gas and oil fields of Northern Alaska. Design of structures, security of sub-surface pipelines, and surface transport of oil is dependent on a knowledge of many of the properties of the near shore pack ice. Observations of ice motions are relevant for three borad reasons: the ice cover serves as a carrier of any petroleum products spilled in the Beaufort or Chukchi Sea so that the ice trajectories serve as a first estimate of the paths to be taken by the oil; the observations identify the important physical processes at work within the ice pack; and the ice motion is an observable quantity that is compared with a simulation of pack ice dynamics. The current study shows the near shore ice pack between Pt. Barrow and Cape Lisburne to move into the central Chukchi Sea during early summer and then to move north and west; probably to be incorporated into the transpolar drift stream. Once the ice moved toward the central Chukchi the mean motion was very similar to the drift of the summer of 1977. (Sinha-OEIS)
W80-04427

SEDIMENTOLOGY AND GEOCHEMISTRY OF SURFACE SEDIMENTS AND THE DISTRIBUTION OF FAULTS AND POTENTIALLY UNSTABLE SEDIMENTS, ST. GEORGE BASIN REGION OF THE OUTER CONTINENTAL SHELF, SOUTHERN BERING SEA,
Geological Survey, Menlo Park, CA.
J. V. Gardner, T. L. Vallier, W. E. Dean, K. Kvenvolden, and G. D. Redden.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 2: Physical Science Studies, p 181-271, December 1979. 35 Fig, 14 Tab, 66 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Seismology, *Geology, *Hazards, Alaska, Sediments, Geochemistry, Resources development, Baseline studies, *Outer Continental Shelf, Bering Sea, St. George Basin.

The data and interpretations from studies of surface sediments, faults, and areas of potentially unstable sediment masses in the St. George Basin region of the outer continental shelf, southern Bering Sea are summarized. The report is divided into four major parts: Part 1 is an introduction which reviews methods used and the quantity of data collected during the contract period; Part 2 deals with the sedimentology and geochemistry of surface sediments; Part 3 discusses distributions of faults and areas of potentially unstable sediment; and Part 4 is a review of the major conclusions. Major faults are principally distributed along or near the borders of St. George basin and they trend parallel to the basin's long axis. Minor faults are widely distributed throughout the middle of St. George basin. Major faults are probably related to stress fields established by Mesozoic and Cenozoic plate motions and minor faults are related to high seismicity in the nearby Aleutian subduction zone. (Sinha-OEIS)
W80-04428

COASTAL PROCESSES AND MORPHOLOGY OF THE BERING SEA COAST OF ALASKA,
Geological Survey, Menlo Park, CA.
A. H. Sallenger, Jr., and J. R. Dingler.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 2: Physical Science Studies, p 377-441, December 1979. 29 Fig, 3 Tab, 16 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Morphology, *Geology, *Storms, *Hazards, *Baseline studies, Alaska, Resources development, Coasts, Paths of pollutants, Water pollution, Environmental effects, *Outer Continental Shelf, Bering Sea, Petroleum development, Coastal development set-back line.

The regional characterization of the physical environment of the Bering Sea coast of Alaska included determination of net longshore transport directions, characterization of coastal morphology, and reconnaissance of beach morphology and sediment characteristics. These types of studies were extended to Pavlov Bay and Cold Bay on the Pacific coast of the Alaska Peninsula. These potential deep water ports may serve offshore petroleum exploitation of the Bristol Bay area in the future. Results of these studies are used to obtain qualitative assessment of coastal stability, in preparing preliminary siting studies for coastal developments, and in the determination of the long-term directions of transport of particulate pollutants in the littoral system. Shallow offshore depths that characterize much of

the eastern Bering Sea shelf make coastal areas susceptible to storm surges of large magnitude. Potential consequences of storms in this environment pose hazards to coastal developments in addition to hazards resulting from flooding and wave activity alone. One use for this kind of data is to establish a coastal development set-back line. Developments within areas subject to inundation by storm surge or undermining by coastal erosion would be prohibited. Additional input into this analysis must include the long-term rate of erosion. For structures that must cross the coastline (e.g. pipelines) the maximum scour depth must be established for both storms and over the long-term. (Sinha-OEIS)
W80-04430

OIL SPILL TRAJECTORY ANALYSIS LOWER COOK INLET, ALASKA,
Dames and Moore, Los Angeles, CA.
R. Schlueter.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Vol 2: Physical Science Studies, p 442-745, December 1979. 19 Fig, 8 Tab, 22 Ref, 4 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil spills, *Model studies, *Baseline studies, *Water pollution effects, Alaska, Currents(Water), Wind velocity, Resourced development, Environmental effects, *Outer Continental Shelf, *Trajectories, Petroleum development, Cook inlet.

In continuing studies of the behavior of spilled oil in Lower Cook Inlet, behavior of a surface oil slick was represented by the trajectory of the centroid of the slick neglecting mass-dependent phenomena such as spreading, evaporation, sinking, etc. The velocity of the centroid was modeled as the linear, vectorial addition of wind velocity coupled to centroidal velocity by a coefficient of 3% and the total surface current velocity. A Dames & Moore oil spill numerical model embodying these concepts was used to carry out the analyses. The results of this project include not only the predicted oil spill behavior, but also the input wind and current fields. The fields developed represent the most recent synthesis of current measurement and modeling results available in October 1978. An overview of the oil spill model is given which provides the general framework of the analytic approach used to determine shoreline exposure due to postulated oil spills at selected sites. Details of the model, details of the environmental input data and a discussion of the methodology and results of the trajectory simulations are also presented. (Sinha-OEIS)
W80-04431

THE EFFECTS OF LOW LEVELS OF OIL ON AQUATIC BIRDS. A NON-TECHNICAL SUMMARY OF RESEARCH ACTIVITIES FY76 THROUGH FY78,
College of the Atlantic, Bar Harbor, ME.
J. O. Biderman, and W. H. Drury.
US Fish and Wildlife Service Biological Services Program Report No FWS/OBS-80-16, March 1980. 5 p, 1 Ref, Conducted in Cooperation with US Environmental Protection Agency.

Descriptors: *Birds, *Water pollution effects, *Oil pollution, Reproduction, Resources development, Environmental effects, *Outer Continental Shelf, Aquatic birds.

The reproductive period, including the time of growth and development of the young, is a highly sensitive time for any animal when physiological systems are acting at critical rates. Any slight interference, such as the addition of a stressful or toxic agent is likely to be disastrous. It has been demonstrated that exposure of adult waterbirds or their developing young to slight amounts of petroleum can seriously interfere with the reproductive process. Effects can range from interference with the physiology of reproduction to killing of embryos, production of developmental defects, stunting of growth and impairment of survival ability when birds are stressed. Oil can be taken up by adults in their food or picked up on their feathers, and can be transferred to eggs or nestlings. Managers should be conscious of these effects, which though less apparent in nature, may in fact be more serious than the infrequent kill-offs occurring after catastrophic spills. For it may well turn out that a chronic reduction in reproductive success may be the most significant effect of oil pollution on populations of aquatic birds. (Sinha-OEIS)
W80-04432

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1977-1978. VOLUME I - SYNOPSIS.
National Marine Fisheries Service, Galveston, TX. Southeast Fisheries Center.
Annual Report to the Environmental Protection Agency on work conducted under provisions of the Interagency Agreement during 1977-1978, June 1979. 78 p, 3 Fig, 1 Tab. EPA-IAG-05-E693-EO.

Descriptors: *Oil pollution, *Oil fields, *Water pollution effects, *Environmental effects, Gulf of Mexico, Resources development, Ecosystems, Projects, *Outer Continental Shelf, Environmental assessment, Buccaneer Oil Field.

Volume I - Synopsis is the first of three volumes in an annual report. It is designed to be used as a briefing document and as a key to more detailed scientific and technical information contained in the other volumes. The area selected for study is the operational Buccaneer Oil Field located approximately 49.6 km from Galveston Sea Buoy off Galveston, Texas. Objectives of the project are: (1) to identify and document the types and extent of biological, chemical and physical alterations of the marine ecosystem associated with Buccaneer Oil Field, (2) to determine specific pollutants, their quantity and effects, and (3) to develop the capability to describe and predict fate and effects of Buccaneer Oil Field contaminants. The Buccaneer Field has been in production for about 15 years thus allowing for the full development of oil-field-associated marine communities. There have been no major oil spills from this field although there have undoubtedly been losses of small amounts of oil. This project provides a unique opportunity for continued study of effects of chronic, low-level contamination of the marine ecosystem associated with oil and gas production in an established field. (Sinha-OEIS)
W80-04433

SLUDGE DUMPING: MEETING THE 1981 DEADLINE,
Environmental Protection Agency, New York.
R. T. Dewling, and P. W. Anderson.
In: Marine Technology/79 'Ocean Energy', Proceedings of 15th Annual Conference sponsored by the Marine Technology Society, held New Orleans, Louisiana, October 10-12, 1979. p 34-39, 1979. 3 Fig, 1 Tab. MTS, Washington, D.C.

Descriptors: *Waste disposal, *Sewage sludge, Environmental effects, Water pollution effects, *Outer Continental Shelf, *Ocean dumping, New York Bight.

The Marine Protection, Research and Santuaries Act of 1972 mandates that EPA 'prevent or strictly regulate' the dumping of waste materials into the ocean. The Act was amended in November 1977 to prohibit the dumping of harmful sewage sludge in the ocean after December 31, 1981. Scientific investigations, mainly by NOAA, have documented several adverse environmental impacts at the sludge and dredged material sites. These impacts include elevated concentration of heavy metals, organic matter, and bacterial in the water and bottom sediments with attendant threat of bioaccumulation in the food chain; reduced catches of bony fish in high-carbon sediment areas; FDA closure of extensive areas to shellfishing; enrichment resulting in increased phytoplankton productivity, the occurence of finrot, exoskeleton erosion, and gill clogging in certain marine life; and sediments in the vicinity of the dump sites devoid of normal benthic biological communities. The Congressional mandate has spurred sewage sludge generators to develop and implement alternate disposal methods. All options available have associated environmental risks since metropolitan area sludges contain pathogens, toxic metals, and persistent synthetic organic materials. No matter what method is chosen--landfill, incineration, pyrolysis, composting or recycling, some environmental impact will result. (Sinha-OEIS)
W80-04436

SEAFLOOR SAND MINING IN JAPAN,
National Research Inst. for Pollution and Resources, Tokyo (Japan).
T. Usami, K. Tsurusaki, T. Hirota, and J. W. Padan.
In: Marine Technology/79, 'Ocean Energy', Proceedings of 15th Annual Conference sponsored by the Marine Technology Society, held New Orleans, Louisiana, October 10-12, 1979. p 176-189, 1979. 14 Fig, 3 Tab, 5 Ref. MTS, Washington, D.C.

Descriptors: *Mining, *Resources development, Environmental effects, Erosion, *Outer Continental Shelf, *Offshore mining, Japan.

Rapid depletion of onshore deposits of construction aggregate has caused Japan to tap sand deposits in coastal waters. In recent years offshore mining has contributed 15 to 20% of total production of natural aggregate and about 10% of all aggregate used in Japan. Annual production is 60 to 70 million tons and is expected to increase. This paper describes the role of seafloor sand mining in Japanese industry as well as problems facing the expansion of the industry. Three problems which must be overcome are: the deeper water deposits located by the Geological Survey of Japan must be evaluated; technology to mine as deep as 300 meters, economically, must be developed; and finally, the environmental effects must be held to a minimum. Research will continue to focus on coastal erosion and turbidity effects as the main concerns. (Sinha-OEIS)
W80-04437

ENVIRONMENTAL CONCERNS FOR OTEC IDENTIFIED IN THE DOE OTEC ENVIRONMENTAL READINESS DOCUMENT,
California Univ., Berkeley. Lawrence Berkeley Lab.
K. F. Haven.
In: Marine Technology/79, 'Ocean Energy', Proceedings of 15th Annual Conference sponsored by the Marine Technology Society, held New Orleans, Louisiana, October 10-12, 1979. p 326-330, 1979. 1 Tab. MTS, Washington, D.C.

Descriptors: *Environmental effects, *Hazards, *Energy conversion, *Resources development, Thermal pollution, Water pollution effects, Entrainment, Ecology, *Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC).

The findings and significance of the Department of Energy Environmental Readiness Document (ERD) for OTEC is presented. An ERD is prepared periodically for emerging energy technologies by the DOE Assistant Secretary for Environment and represents an analytical statement of DOE's environmental concerns with the technology. The ERD discusses the current status of knowledge for each concern, the time frame for potential realization of the concern, and the approximate magnitude of the environmental insult which could be realized. Nine environmental concerns are identified for OTEC in the ERD. Six of the nine concerns represent known environmental hazards, yet additional environmental research will be required for each in order to determine both their magnitude and their significance in the open ocean marine environment. (Sinha-OEIS)
W80-04438

1979 STATUS OF THE OTEC ENVIRONMENT PROGRAM,
California Univ., Berkeley. Lawrence Berkeley Lab.
P. Wilde.

In: Marine Technology/79, 'Ocean Energy', Proceedings of 15th Annual Conference sponsored by the Marine Technology Society, held New Orleans, Louisiana, October 10-12, 1979. p 340-345, 1979. 1 Fig, 3 Tab, 9 Ref. MTS, Washington, D.C.

Descriptors: *Water pollution effects, *Energy conversion, *Baseline studies, *Resources development, Thermal pollution, Chemical potential, Gulf of Mexico, Hawaii, Puerto Rico, *Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Ocean properties.

Preliminary surveys and laboratory studies are being conducted in the waters of Puerto Rico, The Gulf of Mexico, and Hawaii for moored or seacoast OTEC plants and in the equatorial South Atlantic for plant-ship operations to provide baseline data. These data plus existing archival information can be used to model effects of OTEC operations. Four major areas of concerns (1) redistribution of oceanic properties, (2) chemical pollution, (3) structural effects, and (4) socio-legal-economic; and 11 key issues associated with OTEC operation have been identified. Mitigating strategies can be used to alleviate many deleterious environmental effects of operational problems as biostimulation, outgassing, etc. Various assessment research studies on toxicity, biocide releases, etc., are under way to investigate areas where no clear mitigating strategy is available. Data from these programs is being integrated into a series of environmental compliance documents including a programmatic environmental impact assessment. (Sinha-OEIS)
W80-04439

COASTAL FRONTAL SYSTEMS AS A POLLUTANT CONTROL MECHANISM FOR OFFSHORE ENERGY PRODUCTION,
Science Applications, Inc., Bryan, TX. Ocean Science Div.
J. K. Lewisk.
In: Marine Technology 79, 'Ocean Energy', Proceedings of 15th Annual Conference sponsored by the Marine Technology Society, held New Orleans, Louisiana, October 10-12, 1979. p 389-396, 1979. 3 Fig, 3 Tab, 9 Ref. MTS, Washington, D.C.

Descriptors: *Environmental effects, *Oil pollution, *Oil spills, *Resources development, Water pollution control, Texas, Dispersion, Wind, *Outer Continental Shelf, Oil and gas production, Coastal frontal system.

A surface core of fresher water from the Mississippi Delta region is advected along the Texas coast due to longshore wind stress and can form a strong frontal zone 10-30 km offshore of an area where much oil and gas production occurs. Coastal fronts are environmentally important since the surface convergences that occur at the boundary of the dissimilar water types are capable of affecting the dispersal of spilled pollutants. This front can be considered as a buffer between offshore pollutant spills and the tourist-attractive coasts of Texas. The front can dominate the nearshore environment for much of the year, and historical wind stress data indicate that it could be expected along the upper Texas coast from September through April. The mechanism which support the frontal zone is discussed, and the results indicate that other as of yet undetected fronts may exist in areas close to river outflows. The flow regimes of the front are presented, the knowledge of which would allow private and government agencies to better plan contigencies for handling spills from offshore energy production or transport. (Sinha-OEIS)
W80-04440

AN EMPIRICAL STUDY OF FACTORS AFFECTING BLUE-GREEN VERSUS NONBLUE-GREEN ALGAL DOMINANCE IN LAKES,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow, and J. T. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169311, Price codes: A06 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, March 1980. 99 p, 17 Fig, 10 Tab, 65 Ref. OWRT A-102-MICH (3), 14-34-0001-9024.

Descriptors: *Algae, *Cyanophyta, *Lakes, *Blue-green algae, *Nonblue-green algae, *Algal dominance, Hydraulic detention, Variable relationships, Inorganic nitrogen, Hydraulic detention, Nitrogen, Alkaline water, *Temperate lakes, *Variable box plots, *Bivariate-discriminant plots.

In many lakes, the use and enjoyment of the water is limited due to the dominance of undersirable blue-green algae. Exploratory data analysis techniques were applied to 90 north temperate lakes included in the EPA National Eutrophication Survey to examine empirical relationships between: (1) the chemical and physical variables that affect algal dominance in lakes; and (2) the dominant algal type. Single variable box plots and bivariate-discriminant plots document the importance of the inorganic nitrogen concentration and hydraulic detention time in determining blue-green versus nonblue-green algal dominance in eutrophic lakes. The multivariate statistical technique of discriminant analysis was applied to 68 high alkalinity lakes in the data set to: (1) further identify variable relationships; and (2) construct a simple predictive model for algal dominance. Application of results are discussed in an ecological and management context.
W80-04441

STUDIES ON THE USEFULNESS OF DIFFERENT MESH-SIZE PLANKTON NETS FOR THICKENING ZOOPLANKTON,
Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.
J. Ejsmont-Karabin.
Ekologia Polska, Vol 26, No 3, p 479-490, 1978. 2 Fig, 5 Tab, 4 Ref.

Descriptors: *Zooplankton, *Bottom sampling, *Plankton nets, *Eutrophication, *Lakes, Lake Mikolajskie(Poland), Lake Inulec(Poland), On-site data collections, Equipment, Rotifers, Crustaceans, Cyclopidae, Keratella cochlearis, Polyarthra vulgaris, Data collections, Monitoring, Size, Density, Trophic level, Poland.

Eight series of experiments were carried out July 1975 on two eutrophic lakes in Poland to determine how mesh size of a plankton net affects zooplankton composition of filtered samples; recommendations include using nets with smaller mesh sizes (20 micro mm) when filtering plankton in less fertile lakes and using larger mesh sizes (60 micro mm) when filtering plankton in eutrophic lakes. In Mikolajskie Lake (498 ha, 25.9 m max depth, 11.1m avg depth) and Lake Inulec (178.3 ha, 10.1 max depth, 4.6 m avg depth) four tests each were carried out; the tests utilized four different kinds of plankton nets: 10, 20, 30 and 60 micro mm mesh size. Results show that filtering lake water samples through these four net sizes causes losses of the original rotifer numbers; losses are 27%, 32%, 43% and 54%, respectively. Netting does not affect the number of crustaceans, mainly nauplii of Cyclopidae; only 10% of nauplii are lost when 60 micro mm mesh size netting are used. Types and magnitudes of losses among rotifer fauna depends not only on mesh size but also on morphology and body size of individuals and on density of animals within the filtered samples. Generally losses increase with greater individual body size and decrease with greater animal density. It is noted that the average number of eggs per female changes due to filtration; results include a slight reduction for the ovigerous species (Keratella cochlearis) and an almost two-fold increase for non-ovigerous species (Polyarthra vulgaris). (Harris-Wisconsin)
W80-04445

THE USE OF PERIPHYTON FROM LAKE ZURICH TO EXTIMATE THE ALGAL GROWTH POTENTIAL IN RIVER LIMMAT WATER,
Zurich Univ. (Switzerland). Hydrobiology-Limnology Station.
F. Schanz, and B. Betschart.
Swiss Journal of Hydrology, Vol 41, No 1, p 141-149, October 1979. 4 Fig, 2 Tab, 36 Ref.

Descriptors: *Algal growth potential, *Periphyton, *Bioassay, *River Limmat(Switzerland), *Sewage effluents, Lake Zurich(Switzerland), Effluents, Algae, Sewage disposal, Biomass, Methodology, Testing procedures, Chlorophyll, Proteins, Growth rates, Analytical techniques, Water water(Pollution), Variability, Laboratory tests, Environmental effects, Water quality, Switzerland.

This paper discusses sewage wastewater influence on algal growth potential in River Limmat water, downstream from Lake Zurich, Switzerland and methods used to estimate algal growth potential (AGP). When natural periphyton under nonsterile conditions is used to estimate AGP in River Limmat water, influence from the Zurich sewage treatment plant can be followed easily. Biomass is estimated by protein determination, chlorophyll determination, KMn04-consumation and ash-free dry weight, using natural periphyton in the bioassay. KMn04-consumption shows lesser standard deviation than is obtained with other determinations. Validity of biomass determination with KMn04-consumption or ash-free dry weight are practically the same. Variation coefficients are generally low. In routine experiments with large numbers of culture vessels, ash-free dryweight determinations are very time consuming. Therefore, KMn04-consumption method is preferred. AGP of the water from Quaibridge (Lake Zurich) to Unterengstringen-right is much lower than the AGP from Unterengstringen-left and sampling stations below. This is due to the influence of the sewage treatment plant Werdholzli immediately upstream of Unterengstringen on the left side of Limmat River. Differences between Unterengstringen-right and Unterengstringen-left are caused by incomplete mixing of river water with wastewater. (Danovich-Wisconsin)
W80-04446

EFFECT OF NUTRIENT INFLOW ON THE BACTERIAL FLORA IN THE RIVER SAKURAGAWA, JAPAN,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, and Y. Takahara.
Internationale Revue Der Gesamten Hydrobiologie, Vol 64, No 3, p 417-424, 1979. 2 Fig, 5 Tab, 5 Ref.

Descriptors: *Eutrophication, *River Sakuragawa(Japan), *Nutrients, *Bacteria, Nitrogen, Phosphorus, Cyanophyta, Trophic level, Inorganic compounds, Domestic wastes, Fertilizers, Water pollution sources, Agricultural runoff, Plankton, Biomass, Density, Heterotrophy, Dystrophy, Nannoplankton, Microorganisms, Japan.

Organic nutrients for bacteria in the Sakuragawa River, Japan during June 1976-July 1977 were mainly autochthonous, suggesting that pollution was never present in sufficient quantity to induce dystrophy. The Sakuragawa drains 349 sq km, 26% of which is paddy fields fertilized by 1900 tons of nitrogen and 1600 tons of phosphorus annually. The city of Tsuchiura also discharges domestic wastes into the river; however, the river discharges only 520 tons of nitrogen and ten tons of phosphorus annually. Nutrient levels and bacteria were collected weekly from sampling stations located in: (1) headwaters free of pollution; (2) just upstream of Tsuchiura where nutrients are increased by agricultural runoff; (3) at the river mouth; and (4) at the estuary harbor. In polluted river areas, the percentage of heterotrophs in bacterioneuston (5.6%) is significantly different from that in bacterioplankton (7.7%). Statistical analysis reveal no significant difference in either percentage at any station in the polluted area. At upstream Station 1, bacterioplankton mean density is 1.6 million cells/ml. In the polluted area, bacterioplankton densities are 8.0 million cells/ml at Station 2; 7.6 million cells/ml at Station 3; and 11.0 million cells/ml at Station 4. Bacterioneuston density varies 8.7 million cells/ml at Station 2; 8.4 million cells/ml at Station 3 and 13.0 million cells/ml at Station 4. Mean density of planktonic heterotrophs at Station 1 ranges 1/50 to 1/100 of the values for polluted areas. (Danovich-Wisconsin)

W80-04447

THE ROLE OF ZOOPLANKTON IN THE NITROGEN DYNAMICS OF A SHALLOW ESTUARY,
Duke Univ., Beaufort, NC. Marine Lab.
S. L. Smith.
Estuarine and Coastal Marine Science, Vol 7, No 6, p 555-565, December 1978. 4 Fig, 2 Tab, 29 Ref. NSF GX33502.

Descriptors: *Zooplankton, *Estuaries, *Cycling nutrients, *Ammonia, *Ureas, *Newport River estuary(NC), Beaufort(NC), Nitrogen, Phytoplankton, Copepods, Primary productivity, Nitrogen cycle, Standing stocks, Shallow water, Nutrients, Nutrient requirements, Foods, Metabolism, Water properties, Water quality, Food chains, Estuarine environment, North Carolina.

Experiments in which nitrogen assimilation by phytoplankton and nitrogen release by copepods was observed in Newport River estuary, North Carolina, September 1973-April 1974, showed that zooplankton are probably not the major source of regenerated nitrogen. Both urea and ammonia are used by phytoplankton in the Beaufort estuary and are released by zooplankton at rates that depend on species, sex, season and feeding history. Phytoplankton primary productivity depends almost totally on regenerated nitrogen; amounts released by zooplankton provided an average of only 16% total phytoplankton nitrogen uptake. Other sources of regenerated nitrogen in the estuary are fish populations, benthic community, fouling community, sewage, microzooplankton and bacteria. Ammonia released by zooplankton averages 8% of the rate of ammonia assimilation by phytoplankton. Percentages range from 1% in October when phytoplankton standing crops are relatively large and phytoplankton ammonia assimilation high to 17% in March when phytoplankton standing stock is small and ammonia assimilation low. Release rates range 0.1-9.7 mg N/cu m d, while assimilation rates range 1-101 mg N/cu m d. Newport River estuary is part of a series of shallow estuaries behind the Outer Bands of North Carolina; average depth is 1.2 m. The estuary receives runoff from fertilized farmland, effluents from fish processing plants, and sewage from primary and secondary treatment plants. Copepod Acartia tonsa is numerically dominant at all times. (Danovich-Wisconsin)
W80-04448

ALGAL RESPONSE TO A THERMAL EFFLUENT: STUDY OF A POWER STATION ON THE PROVO RIVER, UTAH, USA,
Bringham Young Univ., Provo, UT. Dept. of Botany and Range Science.
L. E. Squires, S. R. Rushforth, and J. D. Brotherson.
Hydrobiologia, Vol 63, No 1, p 17-32, March 1979. 9 Fig, 2 Tab, 33 Ref.

Descriptors: *Provo River(UT), *Thermal pollution, *Electric powerplants, *Sessile algae, *Environmental effects, Algae, Diatoms, Thermal stress, Thermal water, Water temperature, Effluents, Primary productivity, Distribution, Speciation, Growth rates, Environmental gradient, Statistics, Statistical methods, Periphyton.

Water temperature increases caused by thermal discharges are highest 100-135 m downstream of the Hale generating station on the Provo River in Utah and a unique algal community is attributed to this thermal discharge. The attached algal community of this small fast-moving mountain river was observed October 1975-August 1977. Diatoms, Cladophora glomerata, and Hydrurus foetidus are major constitutents. Cocconeis placentula (euglypta) is common throughout the year and dominates diatom flora spring to fall. C. glomerata and H. foetidus are abundant fall to spring. Flora display an overall similarity in specific composition but with zonation related to local environmental conditions. Effects from elevated temperatures in river sections below the effluent area could not be distinctly isolated; however, the effluent area which estends 100-135 m downstream from the thermal discharge point contains flora significantly different from other river areas. The effluent area is characterized by heavy C. glomerata growth, lack of foetidus growth, high diatom production but low diversity, C. placentula dominance throughout the year and a consistently distinct diatom community composition. Temperatures in this area range 0-10C above ambient just below the outfall and 0-3.5C above ambient 135 m downstream. (Danovich-Wisconsin)
W80-04449

SPATIAL PATTERNS IN NORTH SEA PLANKTON,
Woods Hole Oceanographic Institution, MA.
J. H. Steele, and E. W. Henderson.
Deep-Sea Research, Part A-Oceanographic Research Papers, Vol 26, No 8, p 955-963, August 1979. 6 Fig, 16 Ref.

Descriptors: *Population dynamics, *Spatial distribution, *North Sea, *Plankton, Ecosystems, Distribution, Zooplankton, Grazing, Growth rates, Population, Temperature, Chlorophyll, Temporal distribution, Physical properties, Variability, Theoretical analysis, Nutrients, Phytoplankton.

Surveys of near-surface horizontal distributions of temperature, salinity, nitrate and chlorophyll were carried out April-June 1976 in the North Sea; results make it possible to distinguish periods when phytoplankton growth is affected mainly by physical dispersion from periods when grazing is the controlling factor. Data on chlorophyll and zooplankton concentrations confirm great variability in space and time, especially in scales 0.1-100 km and 1-100 days and this makes it difficult to interpret temporal sequences of data in terms of separate or combined effects of physical processes, nutrient limitation or grazing. The 1976 growth sequence, although irregular, was much lower than in earlier 1974 studies; this could have resulted from nutrient limitation. The spectral ratio of chlorophyll to temperature decreases or increases with increasing wave number for positive or negative growth rates. The variance slope ratio of chlorophyll and temperature is used to measure chlorophyll spectra divergence from that expected solely from physical processes. During periods of phytoplankton growth or significant plant-herbivore interactions, the slope is negative indicating increased biological variance at low wave numbers. Positive slope corresponds to a dominance of the limiting effects of nutrient and physical factors on phytoplankton with declining populations. A zero slope indicates that physical factors alone are dominant in determining phytoplankton distributions. Data indicate that grazing is the controlling factor in May 1976 because the variance slope is negative. (Danovich-Wisconsin)
W80-04450

FECUNDITY AND BODY SIZE OF PLANKTIC ROTIFERS IN 30 POLISH LAKES OF VARIOUS TROPHIC STATE,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
W. Sterzynski.
Ekologia Polska, Vol 27, No 2, p 307-321, 1979. 3 Fig, 1 Tab, 35 Ref.

Descriptors: *Lakes, *Rotifers, *Fecundity, *Size, *Food abundance, Pelagic zone, Zooplankton, Trophic level, Foods, Dissolved oxygen, Oxygen, Productivity, Length, Correlation analysis, Speciation, Pomeranian Lake region(Poland), Poland.

Investigations of 30 Polish lakes in the Pomeranian region June-July 1975 demonstrate that under natural conditions even when lakes are not much different with regard to food resources, food is a significant factor controlling rotifer fecundity and size. Oxygen deficit in hypolimnion layers was treated as a basic trophic index and thus of lake biological production and food resources. Both June and July populations exhibit very high fecundity variations. Polyarthra sp had the highest variability range and highest average fecundity. With increasing food resources, fecundity of Keratella cochlearis, K. quadrata and Polyarthra sp increased, whereas Kellicottia longispina fecundity decreased. K. cochlearis and Polyarthra sp fecundity depended mostly on food abundance. With increasing food supply, rotifer body length decreased. K. cochlearis and K. quadrata size changed the most; K. longispina size changed only slightly. Average body length of K. cochlearis in July was 11.4% smaller than in June; K. quadrata decreased analogously by 7.2% and K. longispina by only 1.9%. The Pomeranian lake region has no oligotrophic lakes; however, the trophic index, oxygen deficit, ranged 15.5% to 97.4% in June. (Danovich-Wisconsin)
W80-04451

MECHANISMS OF RAPID PHOTOSYNTHETIC ADAPTATION IN NATURAL PHYTOPLANKTON COMMUNITIES. I. REDISTRIBUTION OF EXCITATION ENERGY BETWEEN PHOTOSYSTEMS I AND II,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
W. F. Vincent.
Journal of Phycology, Vol 15, No 4, p 429-434, December 1979. 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Phytoplankton, *Light intensity, *Lake Windermere(Great Britain), *Photosynthesis, *Adaptation, Lakes, Chlorophyll, New Zealand, Fluorescence, Trophic level, Aquatic plants, Irradiation, Bioluminescence, Light, Surfaces, Light penetration, Population, Metabolism, Plant physiology, Great Britain.

Intensities of in-vivo chlorophyll fluorescence were recorded for water columns of six (New Zealand, England) lakes of different trophic status and phytoplankton composition. Decreased yields in chlorophyll fluorescence were recorded in surface waters of all lakes, irrespective of trophic status or location. Beyond a threshold light level in each lake, fluorescence light decreased with increasing light intensity. For five New Zealand lakes, which were all surveyed in late winter under the same irradiance conditions (1500 microEin/sq m/second), all threshold light intensities lay within 54-62% of surface illuminance. The time course of fluorescence depression and recovery process was examined with Lake Windermere (England) samples. Fluorescence exponentially decreases upon exposure to bright light, the response is 100% (5 m samples) and 83% (dim light-adapted 0 m samples) complete within 2 minutes. Chlorophyll fluorescence values increase in dim light after a lag of 60 seconds; the rate of increase decreases exponentially with time. Deep (6.5 m) populations from Lake Windermere exhibit time-dependent variations in chlorophyll fluorescence over the first 25 seconds of exposure to 450 nm light. These observations are interpreted in terms of decreased spillover from photosystem II to photosystem I with increasing depth, to a minimum at threshold light intensity below which cells are in light state I. (Harris-Wisconsin)
W80-04452

SUBFOSSIL CHIRONOMIDS AS EVIDENCE OF EUTROPHICATION IN EKOLN BAY, CENTRAL SWEDEN,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
T. Wiederholm, and L. Eriksson.
Hydrobiologia, Vol 62, No 3, p 195-208, February 1979. 7 Fig, 3 Tab, 23 Ref.

Descriptors: *Ekoln Bay(Sweden), *Cores, *Sediments, *Trophic level, *Chironomidae, *Paleolimnology, Lake Malaren, Sweden, Eutrophication, Tubificids, Benthic fauna, Diptera, Limnology, History, Paleohydrology, Nutrients, Ecology, Ecosystems, Chlorophyll, Distribution, Speciation, Phosphorus, Nitrogen, Fertilizers.

Stratification of chironomid head capsules within three 65-76 cm sediment cores taken from Ekoln Bay, a highly eutrophic basin in Lake Malaren, central Sweden, reflects the lake's trophic status over the past 150 years. Successive but slow eutrophication due to more intensive land use occurred from the 1800's to 1920's. A more rapid change in trophic conditions resulting in bottom water oxygen depletion occurred 1940-1950. Changes were presumably caused by increased sewage load-

ing and more extensive use of commercial fertilizers in agriculture. Highly eutrophic conditions continued until recent years. With information from numerous Swedish lake studies, subfossil chironomid assemblages were used to estimate nutrient and chlorophyll levels in Ekoln Bay during different time periods. Reducing nutrient loading through advanced sewage treatment would half phytoplankton biomass from that occurring during the last ten years. Sediment cores revealed 819 individuals distributed over 21 genera. Phaenopsectra, Chironomus and Procladius account for 65% of the material; Micropsectra and Tanytarsus make up an additional 25%. Micropsectra and Phaenopsectra are strongly associated with oligotrophic-mesotrophic conditions. In the top 20 cm Chironomus and Procladius were by far the most abundant taxa. (Danovich-Wisconsin)
W80-04453

PHOSPHATE REQUIREMENT OF ANABAENA OSCILLARIOIDES AND ITS ECOLOGICAL IMPLICATIONS,
Auckland Univ. (New Zealand). Dept. of Botany.
C. W. Y. Lam.
Hydrobiologia, Vol 67, No 1, p 89-96, November 1979. 5 Fig, 2 Tab, 32 Ref.

Descriptors: *Anabaena, *Nutrient requirements, *Phosphates, *Waikato River(New Zealand), Cyanophyta, Algae, Phosphorus, Ecology, Environmental effects, Laboratory tests, Cytological studies, Cultures, Growth rates, Enzymes, Limiting factors, Metabolism, Plant physiology, Population, Primary productivity, New Zealand.

Anabaena oscillarioides when grown in filtered water from the Waikato River, New Zealand, produces well-recognized phosphorus (P)-deficiency symptoms such as high alkaline phosphatase activity and low intracellular P content, indicating that the river phosphate content is inadequate to support good algal growth. With phosphate supplements, all P-deficiency characteristics disappear, confirming that phosphate is the limiting nutrient for Anabaena in the Waikata River. Filtered river water supplemented with 1000 micro g P/l above ambient levels, sustains a much higher Anabaena growth (5.1 million cells/ml) when compared with ambient river water (1.8 million cells/ml) after eight days growth. The highest intracellular P content in P-supplemented algae is 0.066 micron micro g P/cell and in ambient water 0.0094 micron micro g P/cell; the minimum P content in inoculum algae is 0.0016 micron micro g P/cell. Rinal algal yields increase with phosphate-P concentrations 0-100 micro g/l; beyond 100 micro g/l, increases in phosphate concentrations do not affect the growth rate significantly but do increase final algal yields. Ks, the half-saturation constant, is 67 micro g/l; this low phosphate affinity probably does not allow algal growth to proceed at high rates. When river water is supplemented with 100 micro g P/l, doubling time is reduced from two days to 0.5 days. (Danovich-Wisconsin)
W80-04454

DIATOM ASSOCIATIONS AND SUCCESSION IN LAKE KARIBA, SOUTH CENTRAL AFRICA,
University of the Witwatersand, Johannesburg (South Africa).
F. D. Hancock.
Hydrobiologia, Vol 67, No 1, p 33-50, November 1979. 8 Fig, 1 Tab, 31 Ref.

Descriptors: *Diatoms, *Succession, *Speciation, *Lake Kariba, Africa, *Spatial distribution, *Lake basins, Plankton, Algae, Distribution, Seasonal, Melosira, Limnology, Lake morphology, Biomass, Water temperature, Dominant organisms, Hydroelectric plants, Dams, Pondage, Population, Zambesi River(Africa), Africa, Zambia, Rhodesia.

Except for the northeast Sanyati sub-basin (part of Lake Kariba, a very large lake formed between Zambia and Rhodesia for hydroelectric power) diatom associations show a gradual change from upper to lower lake and basin individuality is not evident. Kariba was studied 1959-1972 and diatom associations were analyzed in relation to the thermal cycle in different lake basins. A dominant association composed of Melosira granulata, M. granulata angustissima and M. distans alpigena demonstrate a succession pattern. The first two species, by variations in their percentage occurrence, show a gradual change from lacustrine conditions prevailing at the barrier area of the Sanyati basin to riverine conditions of uppermost basins. A second association formed by Cyclotella, Fragilaria and Synedra species is a regular feature of the diatom population. It is sub-dominant to the Melosira association in the barrier area but becomes more reduced in up river basins. The northeast Sanyati sub-basin disrupts the general pattern and shows individuality; accidental and ambivalent plankters are co-dominant with the Melosira association during homothermy. Lake Kariba is warm (17-32C), monomicitic and mesotrophic. Upper basins are influenced by Zambesi River, the lower basins by climatic conditions. Overturn commences in March in riverine basins and in May at the barrier with 21-22C average water temperatures. Stratification commences in upper basins in June and occurs in August in lower basins. (Danovich-Wisconsin)
W80-04455

STEADY-STATE GROWTH AND CHEMICAL COMPOSITION OF THE MARINE CHLOROPHYTE DUNALIELLA TERTIOLECTA IN NITROGEN-LIMITED CONTINUOUS CULTURES,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman, and D. G. Peavey.
Applied and Environmental Microbiology, Vol 38, No 5, p 894-901, November 1979. 6 Fig, 2 Tab, 35 Ref. NOAA 04-8-M01-149 and NSF OCE-7819420.

Descriptors: *Cultures, *Limiting factors, *Nitrogen, *Chlorophyta, *Growth rates, *Laboratory tests, Carbon, Phosphorus, Marine algae, Equations, Culture media, Nutrients, Chemical properties, Phytoplankton, Dunaliella tertiolecta, Nitrates, Ureas, Nitrites, Ammonia, Cytological studies.

Continuous-culture experiments of marine chlorophyte Dunaliella tertiolecta under ammonia-, nitrate-, nitrite- and urea-N limitations show that this species can adapt to exploit different potentially available nitrogen (N) sources in natural water without appreciable differences in growth rates. The highest dilution rate which maintains a steady-state population is 1.33/d. Nitrogen cell quota (Q-n) varies from 1.3 pg of N/cell (k-Q) at zero growth rate (u=0) to 7.0 pg of N/cell (Q-m) at a maximum growth rate (u-max). Under enriched batch conditions, Q-m is 8.8 pg of N/cell. Specific growth rate is 1.66/d. The ratio between the minimum cell quota (k-Q) and maximum cell quota (Q-m) is 0.19; therefore, there is no substitute for determining u-max experimentally. Trends in carbon (Q-c) and phosphorus (Q-p) cell quotas with varying steady state growth are very similar: virtually no effect of growth on either cell quota up to u=1.1/d (=0.8 u-max), followed by very rapid increase up to u-max, indicating that a threshold value must be reached before growth occurs. Values of u-max are similar when determined either by cell washout technique or batch growth in enriched medium. Results indicate physiological limits in cellular constituency under N limitation; however, this information does not provide clues to natural population responses to nutrient exposures which vary temporally and spatially on a microscale. (Danovich-Wisconsin)
W80-04456

FACTORS CAUSING ELEVATED BIOLOGICAL OXYGEN DEMAND IN THE LITTORAL ZONE OF LAKE WINGRA, WISCONSIN,
Wisconsin Univ., Madison. Dept. of Botany.
S. R. Carpenter, A. Gurevitch, and M. S. Adams.
Hydrobiologia, Vol 67, No 1, p 3-9, November 1979. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Biochemical oxygen demand, *Littoral, *Lake Wingra(WI), *Macrophytes, *Leachate, *Eutrophication, Pelagic zone, Organic matter, Myriophyllum spicatum, Nitrates, Ammonia, Phosphates, Correlation analysis, Organic compounds, Inorganic compounds, Phosphorus, Water temperature, Aquatic weeds, Carbon, Decomposing organic matter, Wisconsin.

High BOD values that occur in filtered littoral waters in Lake Wingra, Wisconsin are due primarily to greater concentrations of labile dissolved organic carbon, and secondarily to greater dissolved phosphate concentrations. Increased organic carbon accounts for most of the increased oxygen uptake, although phosphate stimulates BOD to some degree. Lake Wingra weedbeds add labile dissolved organic carbon to littoral waters. Between June and September, littoral BOD averages 0.31 mg/l higher than that of pelagic water. Effects of several environmental factors (water temperature; phosphate, nitrate or ammonia concentrations; and dissolved organic matter from decaying macrophytes) on BOD in filtered Lake Wingra water was examined. Low correlation was observed between BOD and water temperature. Although inorganic phosphorus does not significantly correlate with BOD in field data, phosphate has a small but significant effect on BOD in enrichment experiments. Dissolved organic phosphorus significantly correlates with BOD in field data; enrichment with macrophyte leachate markedly affects BOD. Nearly all macrophyte leachate oxidizes during BOD incubations. BOD is not influenced by nitrate or ammonia enrichments. Lake Wingra is a hardwater eutrophic lake with 2.4 m mean depth. Dense week beds dominated by Myriophyllum spicatum (Eurasian water-milfoil) cover a third of the lake's surface. (Danovich-Wisconsin)
W80-04457

A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN EASTERN NORTH-CENTRAL, AND SOUTHEASTERN UNITED STATES.
National Eutrophication Survey, Corvallis, OR.
Working Paper No 475, September 1978. 268 p.

Descriptors: *Basic data collections, *National Eutrophication Survey, *Lakes, *Regions, *Reservoirs, *Trophic level, Atlantic coastal plain, Central U.S., Appalachian Mountain region, Northeast U.S., Southeast U.S., Eutrophication, Mesotrophy, Oligotrophy, Lake morphometry, Physicochemical properties, Biological properties, Cycling nutrients, Nonpoint sources, Nutrients, Data collections.

Individual lake and reservoir reports for 153 bodies of water in 17 eastern U.S. states include data on trophic conditions; nutrient sources, loads and controllability; and limiting nutrients. Each report also includes National Eutrophication Survey (NES) data pertaining to the water body, the drainage area, and nutrient point sources. To make NES data accessible to many users, data in each lake report are summarized and include information on water bodies sampled during the second year of the survey. States included here are Alabama, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Maryland, Mississippi, New Jersey, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia. Trophic conditions for each lake are based on an assessment of data collected during the sampling year supplemented by results of past studies, if any, and communications with state personnel. Each water body is characterized either as 'oligotrophic' (implying low nutrient levels and productivity), 'eutrophic' (with high nutrient levels and productivity), 'mesotrophic' (with moderate nutrient levels and productivity) or 'hypereutrophic' (with very high nutrient levels and productivity). For large water bodies, two or more trophic categories are sometimes indicated. Data are arranged in five categories: (1) morphometry, (2) physical and chemical characteristics, (3) biological characteristics, (4) nutrient loading characteristics, and (5) nonpoint source nutrient export. (Harris-Wisconsin)
W80-04458

A TIME- AND DEPTH-DEPENDENT MODEL FOR PHYSICAL, CHEMICAL AND BIOLOGICAL CYCLES IN TEMPERATE LAKES,

Washington Univ., Seattle. Dept. of Oceanography.
R. A. Walters.
Ecological Modelling, Vol 8, p 79-96, January 1980. 5 Fig, 1 Tab, 36 Ref.

Descriptors: *Mathematical models, *Mixing, *Physical properties, *Biological properties, *Lakes, *Temperate, *Primary productivity, Stimulation analysis, Turbulence, Cycles, Water temperature, Thermal stratification, Mathematical studies, Equations, Lake Washington(WA), Chemical properties, Cycling nutrients, Phytoplankton, Growth rates, Time, Depth, Diffusion.

A model has been developed in which eddy diffusion of algal cells and dissolved nutrients is consistent with mixing processes which influence the thermal structure of the lake. Using standard modeling formulations for net production, respiration and nutrient uptake, results show that chlorophyll-a and nutrient distributions are controlled to a large extent by turbulent mixing processes considered in the thermal model. The thermal model follows the general approach of Sundaram and Rehm which leads to a physically realistic description of temperature structure, particularly around the start of stratification in spring. The general biological model considers dependent variables as continuous in space and time, and details nutrient movements within lakes. The biological production model is formulated in terms of paired, coupled, nonlinear partial differential equations governing chlorophyll-a and dissolved phosphorus distributions. The equations are solved by finite differences and iteration techniques. A number of formulations for eddy diffusivity in the epilimnion and hypolimnion were evaluated and the results are compared with 1963 data for Lake Washington, Washington. Simulation results compare favorably with measured distributions in Lake Washington. It concludes that a close relationship can exist between the stratification cycle and algal-nutrient distributions. The numerical model was developed to study complex relationships between physical, chemical and biological processes occurring in many deep, stratified temperate lakes. (Danovich-Wisconsin)
W80-04460

A COMPUTATIONAL MODEL FOR GROWTH AND HARVESTING OF THE MARINE ALGA ASCOPHYLLUM NODOSUM,
Central Inst. for Industrial Research, Oslo (Norway).
K. L. Seip.
Ecological Modeling, Vol 8, p 189-199, January 1980. 5 Fig, 2 Tab, 28 Ref.

Descriptors: *Norway, *Harvesting of algae, *Cutting management, *Mathematical models, *Vegetation regrowth, Ascophyllum, *Algae, Growth rates, Harvesting, Time, Productivity, Biomass, Natural resources, Resources management, Mortality, Density, Curves, Long-term planning, Aquatic weeds, Marine algae, Simulation analysis.

A simulation model for the growth and harvesting of marine alga Ascophyllum nodosum in northern and western Norway shows that yield depends upon environmental factors and on harvesting procedures. For a given area and a given technology, the optimum harvesting strategy is determined in terms of harvesting frequency and cutting degree. Two different harvesting strategies are developed, one giving high instantaneous yield and the other giving high long-term yield. The latter incorporates elements of counterintuitivity on a practical level, but this strategy is preferred as new and more efficient algal cutting devices are introduced. At frequent harvesting intervals substantially less algal biomass should be removed than is technologically feasible with current implements. For each choice of regrowth period, an optimum cutting degree is found with respect to long-term yield. At periods of two, three and four years, a base vegetation of 20%-30%, 8%-10% and 3%-4% should be left for regrowth, respectively. A full size plant takes 5-8 years to grow. Annual mortality rates vary depending upon locality and climatic changes. A significant increase in average mortality occurs along a gradient from sheltered localities (20% mortality) to exposed localities (40% mortality). Yields increase by 50% when mortality decreases 40%-18% with a traditional cutting degree of 2% carrying capacity. Brown alga Ascophyllum is used in Norway as manure, animal fodder and raw material for seaweed meal and other industrial products. (Danovich-Wisconsin)
W80-04461

ULTRAVIOLET RADIATION AND PHYTOPLANKTON PHOTOSYNTHESIS,
Washington Univ., Seattle. Dept. of Oceanography.
C. J. Lorenzen.
Limnology and Oceanography, Vol 24, No 6, p 1117-1120, November 1979. 2 Fig, 9 Ref. NSF DES 74-00653A1.

Descriptors: *Phytoplankton, *Photosynthesis, *Ultraviolet radiation, *Coasts, *Oceans, Environmental effects, Puget Sound(WA), Pacific Ocean, Africa, Light, Radiation, Depth, Electromagnetic waves, Solar radiation, Euphotic zone, Ozone, Algae, Metabolism, Plant physiology.

Effects of present-day ultraviolet-B (290-320 nm) levels on phytoplankton photosynthesis and possible effects of elevated UV-B levels are assessed; UV-B removal increases C-14 incorporation and threshold levels occur at rather low absolute values. Therefore, a reasonable fraction, even up to 50%, of the euphotic zone experiences photosynthetic activity suppression due to natural present-day UV-B levels. Doubling of UV-B affects a layer 4.6 m and 0.2 m for oceanic and coastal waters, respectively. Observations were taken at four geographical locations: Puget Sound; shelf waters off the Washington coast; open ocean in the North Pacific; and shelf waters off northwest Africa. In coastal waters with 5 m euphotic zone, differences in C-14 uptake are detected at 1.2-1.5 m; this corresponds to 0.1-0.01% surface UV-B levels. In open ocean waters, a larger fraction of the euphotic zone is similarly affected. A sunburning radiation of 600 counts/30 min corresponds to UV-B levels experienced at local apparent noon when total incident radiation is 1.25 ly/min. Effects of UV-B levels on photosynthesis probably does not alter data on estimates of oceanic production. However, UV-B effects are important when discussing vertical structures of phytoplankton populations since production estimates in the upper 1/6-1/10 of the euphotic zone are significantly overestimated. Lethal limit of UV-B to algal cells, variability in algal genetic pool in its resistance, repair capability, and the magnitude of vertical mixing in upper euphotic layers are still unknown. (Danovich-Wisconsin)
W80-04462

AN ANALYTICAL INTEGRATION METHOD OF COMPUTING DIURNAL PRIMARY PRODUCTION FROM STEELE'S LIGHT RESPONSE CURVE,
Stockholm Univ. (Sweden). Dept. of Zoology.
A. Engqvist, and S. Sjoberg.
Ecological Modeling, Vol 8, p 219-232, January 1980. 4 Fig, 1 Tab, 11 Ref, 1 Append.

Descriptors: *Light, *Primary productivity, *Curves, *Mathematical studies, *Methodology, Photosynthesis, Analytical techniques, Diurnal, Mathematical models, Ecosystems, Phytoplankton, Aquatic environment, Equations, Time, Depth, Seasonal, Computers, Simulation analysis, Ecology.

Exact time integrals of both Steele's original function and its depth integrated version are deduced analytically, assuming a sinusoidal diurnal variation in light; this method of analytical integration is advantageous in combining high numerical accuracy with comparatively little computational effort. The photosynthesis-light response is an important process in all mathematical models of phytoplankton primary production in aquatic habitats. Steele's mathematical formulations are simple; only one parameter is required to determine the general shape of the light-response curve. Its explicit depth and time integrals are stated but only approximate and/or graphic solutions are attempted for its integration in time. An exact analytical solution is presented as well as an efficient algorithm for its numerical evaluation. The method is tested in a sample diurnal ecosystem simulation. Most primary production takes place in 0-10 m, independent of season; very little production occurs below 20 m. Diurnal production in the mixed layer predicted by Steele's formula is a hyperbolic of light intensity at midday. Production differences at different seasons with the same light intensity at noon, result mainly from different photoperiod lenghts. For winter solstice, equinox and summer solstice, numerical integration with trapezoidal rules requires one and a third, twice and three times more computing time, respectively, to obtain corresponding curves with the same accuracy as analytical integration methods. (Danovich-Wisconsin)
W80-04464

APPLICABILITY OF CELLULAR EQUILIBRIUM AND MONOD THEORY TO PHYTOPLANKTON GROWTH KINETICS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. Di Toro.
Ecological Modeling, Vol 8, p 201-218, January 1980. 4 Fig, 2 Tab, 20 Ref, 1 Append. EPA R803030.

Descriptors: *Nutrients, *Phytoplankton, *Growth rates, *Kinetics, *Monod equation, *Equilibrium, *Metabolism, Nutrient requirements, Michaelis-Menten equations, Biochemistry, Mathematical studies, Biomass, Algae, Cycling nutrients, Approximation method, Population dynamics, Equations, Plant physiology, Cytological studies.

Two classes of kinetics are currently applied to phytoplankton growth: Monod theory states that growth rates depend on external nutrient concentrations while other formulations (Droop, Caperon) emphasize that growth rates depend on internal cellular nutrient concentrations. The more realistic case, in which both internal and external concentrations control uptake, is compared to Monod's growth theory and at steady-state with an appropriate definition for the half-saturation constant, results are essentially equivalent. Variable cellular nutrient concentrations still imply that nutrient stoichiometric ratios change in response to changing external concentrations. However, an important simplification is still possible. Relatively small errors are introduced if internal cellular concentration is assumed to be in dynamic equilibrium with external concentrations. This cellular equilibrium approximation is essentially a computational simplification. It has advantages since no new dynamic state variables are introduced into the formulation. The rapid dynamics of internal cellular concentrations are eliminated which in turn removes the possibility of cells having different internal concentrations within a volume segment since in this approximation, cells equilibrate immediately as they are transported to other volume segments. Computational results indicate cellular equilibrium approximations are adequate when considering nutrient flux to bottom sediments via algal settling if substrate concentration change rates are slow relative to phytoplankton growth rates. (Danovich-Wisconsin)
W80-04465

A RECIPE FOR BAD WATER: WELFARE ECONOMICS AND NUISANCE LAW MIXED WELL,
Franklin Thomas Backus Law School, Cleveland, OH.
For primary bibliographic entry see Field 6E.
W80-04469

5D. Waste Treatment Processes

ANAEROBIC-ACTIVATED CARBON FILTERS FOR THE REMOVAL OF REFRACTORY AND TOXIC ORGANIC COMPOUNDS IN WASTEWATER,
Georgia Inst. of Tech. Atlanta. School of Civil Engineering.
M. T. Suidan, W. H. Cross, M. Fong, J. W.

Calvert, and K. A. Khan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164254, Price codes: A09 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology Technical Completion Report No ERC 08-79, November 1979. 176 p, 62 Fig, 22 Tab, 113 Ref. OWRT A-077-GA (1).

Descriptors: *Waste water treatment, *Phenols, *Anaerobic conditions, *Activated carbon, *Carbon filters, Organic loading, Toxins, Water purification, Pollutants, Industrial wastes, Spectrophotometry, Analytical techniques, Water pollution treatment, Chemical wastes.

An anaerobic filter with granular activated carbon was developed and tested for the effective and energy efficient treatment of waste water containing phenolic compounds. Two identical experimental reactors consisting of four jacketed columns and three clarifiers connected in series were tested. Each column had a reversible recirculation pump for the recirculation of the aqueous contents around each individual reactor. Granular activated carbon served as a media for microbial attachment, substrate concentration, and polarization. A feed substrate flow rate of 2 ml/min giving a total empty bed contact time of 46.48 hours was used with a recirculation flow rate of 50 ml/min. Two phenolic compounds, catechol and o-cresol, were tested at different organic loading rates in the reactors. Three feed concentrations, 200, 400, and 1,000 mg/l, of catechol were tested. For all three satisfactory steady state removal efficiencies were obtained for total organic carbon (81 to 94%), for chemical oxygen demand (88 to 94%), and for catechol (98 to 99%). The system exhibited stability to suddenly increased feed catechol concentrations by increased production of gas. Results were not as positive for the treatment of o-cresol bearing synthetic waste water. Only adsorption onto the activated carbon packing was obtained with no degradation of the o-cresol. While this study showed the potential of the anaerobic-activated carbon filter in the treatment of phenolic compounds, more investigation is recommended. (Seigler-IPA)
W80-04205

IMPROVEMENT OF THE QUALITY OF WASTE POND EFFLUENTS IN NORTHERN AREAS BY CHEMICAL PRE-PRECIPITATION,
Oulu Univ. (Finland). Water Research Lab.
J. U. Airaksinen.
Progress in Water Technology, Vol 10, No 6, p 899-906, 1978. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Finland, *Winter, *Chemical precipitation, *Waste water treatment, *Water temperature, *Costs, Biochemical oxygen demand, Effluents, Water quality, Water pollution control, Waste storage, Phosphorus, Economic efficency, Ponding, Ponds, Sludge disposal, Construction costs, Operating costs, Ii(Finland).

Investigations on several ponds in northern Finland 1974-1976 showed that chemical pre-precipitation increased BOD and phosphorus (P) removals; overall BOD removal rate became 2.5-fold. Study results also show that treatment efficiency decreases with reduced pond temperature as the freezing point is approached. Waste ponding is often the most economical method of treating wastewater; however, in winter with water temperatures 0-8C, ponds become anaerobic and P from bottom sludge returns into solution. The pond at Ii serves 1650 inhabitants and has 260 cu m/d average wastewater flow. Average BOD is 120 mg/l; total P and nitrogen (N) concentrations are 12.5 and 58 mg/l, respectively. Two successive processes occur in the treatment pond: chemical precipitation and biological treatment. Pre-precipitation basins have 300 cu m volume and coagulation is carried out with 230 g/cu m ferric chloride. Due to the use of chemicals and pre-precipitation, BOD removal efficiency increases 53%-84% and total P removal 11%-73%. N reduction is only 20%-30%. Total per-capita construction costs of the improved ponds are $20-$30 of plant costs applying simultaneous precipitation. Chemical precipitation creates large quantities of sludge. Evacuators and pumps are used to remove sludge for communities with more than 500 inhabitants. For smaller communities, a movable belt filter jointly owned by 5-6 communities is the best solution. (Danovich-Wisconsin)
W80-04287

ION EXCHANGE RECOVERY OF COBALT AND COPPER FROM BLACKBIRD MINE DRAINAGE,
Idaho Univ., Moscow. Water Resources Research Inst.
K. A. Prisbrey, J. F. Williams, and H. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-166457, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute. University of Idaho Research Technical Completion Report, January 1980. Presented at the 109th Annual AIME Meeting, Las Vegas, NV, February 24-28, 1980. 25 p, 14 Fig, 2 Tab, 10 Ref. OWRT A-067-IDA(1).

Descriptors: *Cobalt, *Acid mine water, *Mine drainage, *Ion exchange, Water purification, Copper, Idaho, Salmon, Rainbow trout, Spawning, Water pollution sources, Laboratory tests, Flow rates, Mathematical models, Mine wastes, Mining.

The use of gravity flow ion exchange resin beads to reduce acid mine drainage water pollution from the Blackbird Mine, a cobalt mine near Cobalt, Idaho, was examined. The mine is currently closed but, due to international cobalt trade disruptions, the Noranda Mining Company is interested in reopening the mine. The mine is located in a high mountain pass and acid drainage leaks into the Panther Creek drainage system are creating lethal conditions for salmon and steelhead for over 20 miles downstream. Bucktail Creek receives the polluted water and during the early spring it contains 274 ppm of copper and 51 ppm of cobalt, both of which are toxic to aquatic life. Conventional methods for controlling this pollution source are not feasible due to the mountain location and lack of power for equipment operation. Several kinds of ion exchange beads were considered and a macrocreticular weakly acid cation exchanger in sodium form with carboxylic functionality was found to reduce cobalt and copper concentrations to less than 0.1 ppm in creek water. The tough methacrylic acid copolymer provides long life while the large discrete pores allow for easy cation entry and adsorption. Laboratory tests performed on the beads include: equilibrium tests, rate studies on artificial solutions, and rate studies on creek water samples. Field tests were also conducted. A film diffusion model was developed to describe the rate data. (Seigler-IPA)
W80-04296

TREATABILITY OF CARCINOGENIC AND OTHER HAZARDOUS ORGANIC COMPOUNDS,
IIT Research Inst., Chicago, IL.
E. G. Fochtman, and W. Eisenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-11683, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-097, August 1979. 68 p, 4 Fig, 9 Tab, 26 Ref, 2 Append. CI-68-03-2559.

Descriptors: *Organic compounds, *Waste water treatment, *Ozone, *Biodegradation, *Carbon filters, Oxidation, Water pollution treatment, Chemical degradation, Biological treatment, Sewage treatment, Activated carbon, Gas chromatography, Spectrophotometry.

The treatability of five chemical carcinogens in waste water by three treatment methods, biodegradation, carbon adsorption, and ozone oxidation, was examined. The chemical carcinogens tested were: naphthalene (NAP); 1, 1-diphenylhydrazine (DPH); beta-naphthylamine (BNA); 4, 4(1)-methylene-bis (2-chloroaniline) (MOCA); and dimethylnitrosamine (DMNA). The carcinogens were tested at levels of 1 mg/l or less in mineralized distilled water contaminated with the compounds. Both static and continuous reactors were used in the biodegradation tests. For the carbon adsorption tests two commercially available granular activated carbons were used, Filtrasorb 400 and Darco KB. A 12-liter reactor with 1 percent ozone in oxygen was used for the ozone oxidation studies. Analytical techniques used include high performance liquid chromatography, ultraviolet adsorption, high resolution gas chromatography, and spectrophotometric analysis. Results show that NAP can be successfully treated by all three techniques but reaction with ozone occurs slowly. The three carcinogens DPH, BNA, and MOCA can also be treated by all three processes. DMNA is biodegradable in continuous biological reactors but it resists ozone oxidation and is not adsorbed by carbon. Data from study results are given. (Seigler-IPA)
W80-04298

IMPACT OF THE 1977 CLEAN WATER ACT AMENDMENTS ON INDUSTRIAL DISCHARGERS,
Morgan, Lewis and Bockius, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04487

5E. Ultimate Disposal Of Wastes

ACTIVE WASTE-INJECTION SYSTEMS IN FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-04368

IMPACT OF THE 1977 CLEAN WATER ACT AMENDMENTS ON INDUSTRIAL DISCHARGERS,
Morgan, Lewis and Bockius, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04487

5F. Water Treatment and Quality Alteration

RESTORATION OF LAKE NAKSKOV INDREFJORD, DENMARK, USING ALGAL PONDS TO REMOVE NUTRIENTS FROM INFLOWING RIVER WATER,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Nyholm, P. E. Sorensen, K. Olrik, and S. D. Pedersen.
Progress in Water Technology, Vol 10, No 6, p 881-892, 1978. 4 Fig, 2 Tab, 11 Ref.

Descriptors: *Lake Nakskov Indrefjord(Denmark), *Water pollution control, *Nutrient removal, *Phosphorus, *Nitrogen, *Lake restoration, Algae, Nutrients, Effluents, Phytoplankton, Fish, Predation, Zooplankton, Aluminum sulfate, Flotation, Sedimentation, Filtration, Eutrophication, Water quality, Chemical precipitation, Costs, Denmark.

Experiments on lake restoration techniques for Lake Nakskov Indrefjord, Denmark, summer 1974 and 1976, showed that the best method is based on algal separation by alum coagulation followed by dissolved air flotation. Efficient algal separation occurs when alum is used alone without pH adjustment or addition of polymers as a coagulation aid. Phosphorus is reduced 91-93%, resulting in a 0.1 mg/l total phosphorus effluent concentration. Water passage through the algal pond also removes almost 100% of the dissolved nitrogen. Nakskov Indrefjord eutrophication is caused by high nutrient contents from two inflowing rivers, Halsted and Ryde. River water was continuously pumped through two pilot ponds May-October 1976. In Danish climate, algal ponds function only during summer months. In order to avoid zooplankton blooms one of the ponds was stocked with 325 small crucian carps. In the pond without fish, zooplankton predominated and phytoplankton numbers were small, using up little nitrogen. In the pond with fish, sufficient phytoplankton growth took place to make nitrogen growth-limiting. Phosphorus, present in excess, was controlled by

alum coagulation. Sedimentation and filtration methods were examined and also were satisfactory. Construction costs for an algal pond with chemical precipitation and flotation are estimated at $1.1 million. (Danovich-Wisconsin)
W80-04288

WATER QUALITY COMMITTEE-ANNUAL REVIEW OF SIGNIFICANT LEGISLATURE, JUDICIAL AND ADMINISTRATIVE, ACTIVITIES DURING 1977.
American Bar Association, Washington, DC. Natural Resources Law Section.
For primary bibliographic entry see Field 6E.
W80-04472

IMPACT OF THE 1977 CLEAN WATER ACT AMENDMENTS ON INDUSTRIAL DISCHARGERS,
Morgan, Lewis and Bockius, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04487

FEDERAL COMMON LAW: JUDICIALLY ESTABLISHED EFFLUENT STANDARDS AS A REMEDY IN FEDERAL NUISANCE ACTIONS,
For primary bibliographic entry see Field 6E.
W80-04499

5G. Water Quality Control

SOURCES OF PHOSPHORUS IN THE LOUGH NEAGH SYSTEM AND THEIR REDUCTION,
Ministry of Agriculture, Crumlin (Northern Ireland). Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5B.
W80-04227

HYBRID APPROACH IN WATER QUALITY MANAGEMENT,
Goettingen Univ. (Germany, F.R.). Fachbereich Physik.
G. Romberg.
Progress in Water Technology, Vol 11, No 6, p 531-549, 1979. 12 Fig, 3 Tab, 7 Ref.

Descriptors: *Water pollution, *Rivers, *Model studies, Mathematical models, Hydraulic models, Pollutants, Organic matter, Oxygen, Dissolved oxygen, Water quality, Water treatment, Waste water(Pollution), Water pollution control, Analytical techniques, Systems analysis, Hybrid approach, River pollution.

A combination of a mathematical and a physical model (hybrid model) was presented as a tool to practice the following river water quality policies: (1) Water quality standards were designated as upper limits for wasteloads of the river water and as a lower limit on dissolved oxygen in the river water. The pollution introduced into the receiving waters must be controlled in order that these standards be met. (2) A waste discharge pricing policy was recommended. In this policy, each discharger has to pay in proportion to the amount of water quality degradation he causes. The river pollution was assumed to be due to discharges from waste treatment plants. The hybrid approach predicted the water quality degradation due to each discharger separately and allowed to model the following strategies to cope with violations of water quality standards: (1) change of discharge locations, (2) reduction of emission rates including a rollback strategy defined by an optimization problem, and (3) changing the seed of nearfield mixing regions. The effectiveness of these strategies was demonstrated on a special prototype system. (Sims-ISWS)
W80-04256

MODELLING NITRATE CONCENTRATIONS IN PUMPED STORAGE RESERVOIRS,
Ministry of Works and Development, Hamilton (New Zealand). Hamilton Science Centre.
J. C. Rutherford, and J. M. Davis.
Progress in Water Technology, Vol 11, No 6, p 327-336, 1979. 4 Fig, 4 Tab, 6 Ref.

Descriptors: *Reservoirs, *Pumped storage, *Nutrient removal, *Nitrates, Rivers, Lakes, Model studies, Mathematical models, Water temperature, Nutrients, Sodium, Potassium, Magnesium, Nitrogen, Algae, Water quality, Public health, *England.

During autumn and winter, nitrate concentrations exceed WHO limits in some British rivers used for water supply thereby posing a health hazard. Pumped-storage reservoirs act as buffers between raw water supplies and treatment plants attenuating peaks in river nitrate concentration by dilution and removing nitrate by biological processes. This potential could be exploited more fully with the aid of a mathematical model describing nitrate concentration changes which result from inflow, outflow, and biological removal. A zero-dimensional model was found adequate to describe weekly changes in nitrate concentration in two British reservoirs. The model was calibrated on each reservoir separately using one year of data, and then reproduced concentrations in other years with root mean square errors between 12% and 50% of the observed median. Model coefficients for the two reservoirs were significantly different, presumably because of differences in lake morphology and algal populations. This means that at present the model would need to be calibrated for each reservoir. The model can be used to prepare nomographs for a range of likely river nitrate levels, pumping rates, and seasonal temperature distributions. (Sims-ISWS)
W80-04266

HIERARCHICAL-MULTIOBJECTIVE APPROACH IN THE PLANNING AND MANAGEMENT OF WATER AND RELATED LAND RESOURCES,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Department.
P. Das.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-168818, Price codes: A14 in paper copy, A01 in microfiche. Ph.D. Dissertation, June 1976, 298 p, 11 Fig, 29 Tab, 258 Ref, Append. OWRT C-7047(No 6221)(4), 14-34-0001-6221.

Descriptors: *Water resource planning, Multiobjective optimization, Water quality, Surrogate worth trade-off method, Non-point source pollution, Biological oxygen demand, Hierarchical decomposition, Level-B planning, Pareto optimum, *Water management(Applied), *Resources development, Water resources development, *Land management.

A systematic methodological approach to the long-range planning and management of a regional water and related land resources system is presented. The needs for considering and including multiple objective functions in this noncommensurable format and units are discussed. A general multiobjective planning and management model for water and land resources is developed, considering economic development and environmental quality as the two major objectives. The economic objective constitutes the cost of point and nonpoint source pollution control, and the cost of water supply. The environmental quality model includes the following multiple objectives: (1) sediment; (2) phosphorus; (3) biological oxygen demand; and (4) dissolved oxygen deficit level in the stream. The mathematical models developed take into account the interactive nature of both ground and surface water, as well as multiple sources of pollutants from point and nonpoint sources. The Surrogate Worth Trade-off (SWT) method is used for the multi-objective analysis. Since the problem is large, hierarchical decompositions based on geographic and hydrologic boundaries are introduced. Finally, a case study problem on the Maumee River Basin is formulated and solved to illustrate the applicability and efficiency of the multiobjective planning framework developed. (Haimes-CWR)
W80-04291

NITROGEN FIXATION IN A NITROGEN-LIMITED IMPOUNDMENT,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W80-04360

NATIONAL WATER QUALITY INVENTORY 1976 REPORT TO CONGRESS.
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 462, Price codes: A12 in paper copy, A01 in microfiche. Report No EPA-440/9-76-024, June 1977. 273 p, 6 Fig, 13 Tab, 1 Append.

Descriptors: *Water quality, *State governments, *Water pollution control, *Water Pollution Control Act Amendments of 1972(PL 92-500), Baseline studies, Water quality standards, Governmental interrelations, Federal Water Pollution Control Act, Bacteria, Heavy metals, Eutrophication, Urban runoff, Industrial water, Dissolved oxygen, Cycling nutrients, Toxins, Nonpoint sources, Point sources, Great Lakes, Regulation, Industrial wastes.

A summary of current water quality status of the states reiterates for the most part conclusions found in 1974 and 1975 national water quality inventory reports. In this update, excessive bacteria levels which limit recreational water uses are the most widely reported problem, particularly near urban areas, with high phosphorus and nitrogen concentrations also reported in many locations. Low dissolved oxygen levels are a problem primarily in smaller streams receiving large volumes of wastes. Problems with heavy metal contamination are reported by 35 states. Principal sources are industrial discharges, urban runoff and erosion of metals-rich soils and rock deposits; of these, industrial discharges and urban runoff have greatest effects on water quality. Eighteen states report problems with pesticides in water, sediments and fish tissues; but some states report significant improvements following control programs. Pollution from toxic industrial chemicals is reported by 16 states, including all those around the Great Lakes. Fourteen states expect significant improvements by 1983 under national goals posited in the Water Pollution Control Act Amendments of 1972 (PL 92-500). Although states agree with Federal authorities on a fixed schedule for future U.S. funding of municipal sewage treatment facilities, considerably less agreement occurs on future industrial discharge controls; states which discuss the issue generally do not agree with proposals to allow exemptions from 1977 level treatment requirements of PL 92-500 by the U. S. Environmental Protection Agency. (Harris-Wisconsin)
W80-04459

A REGULATED CITIZEN'S BILL OF RIGHTS,
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 6E.
W80-04466

WATER QUALITY COMMITTEE-ANNUAL REVIEW OF SIGNIFICANT LEGISLATURE, JUDICIAL AND ADMINISTRATIVE, ACTIVITIES DURING 1977.
American Bar Association, Washington, DC. Natural Resources Law Section.
For primary bibliographic entry see Field 6E.
W80-04472

WATER QUALITY COMMITTEE (ANNUAL REVIEW OF ACTIVITIES - 1975).
American Bar Association, Washington, DC. Natural Resources Law Section.
For primary bibliographic entry see Field 6E.
W80-04484

FEDERAL COMMON LAW: JUDICIALLY ESTABLISHED EFFLUENT STANDARDS AS A REMEDY IN FEDERAL NUISANCE ACTIONS,
For primary bibliographic entry see Field 6E.
W80-04499

NONPOINT POLLUTION CONTROL IN VIRGINIA,
For primary bibliographic entry see Field 6E.
W80-04500

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

LAND AND WATER RESOURCES PLANNING USING GOAL PROGRAMMING,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. L. Rossmiller, M. D. Dougal, and T. A. Austin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164189, Price codes: A11 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University Completion Report No ISWRRI-95, ISU-ERI-AMES-80010, July 1979. 246 p, 13 Fig, 65 Tab, 66 Ref. OWRT B-060-IA (1).

Descriptors: *Mathematical models, *Land use, *Water resources development, *Iowa, Long-term planning, Irrigation practices, Crops, Water demand, Stock water, Livestock, Land classification, Regional economics, Urbanization, Zoning.

A user-oriented goal programming (GP) model for the utilization of land and water resources for various purposes was developed and applied to a 12-county region in Northwest Iowa. The model encompases both the physical spectrum of supply and demand and the social-institutional-environmental spectrum. The model was developed from an existing computer program that was merged with additional computer code. Model development and constraints are described in detail. The model is input intensive allowing it to be flexible but some of this flexibility is lost due to the incorporation of several constraints. Inputs include run identification data, relative yield potential of corn and soybeans on a land capability class, relative yields, erosion rates, urban and rural residential land use, irrigation, and crop planting scenario. The study area in Northwest Iowa has a low annual rainfall of 25 to 28 inches per year and groundwater is not available in sufficient quantities for many uses. The area encompasses 12.8% of the total area of the state but only 10.2% of the population. Results of model application show that the water resources of the Iowa region are adequate to meet all demands with an investment of approximately one billion dollars for the construction of 24 reservoirs, thousands of wells, miles of pipeline, and several pumping stations. Goal programming was found to be a successful tool in resource planning. (Seigler-IPA)
W80-04202

HIERARCHICAL-MULTIOBJECTIVE APPROACH IN THE PLANNING AND MANAGEMENT OF WATER AND RELATED LAND RESOURCES,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Department.
For primary bibliographic entry see Field 5G.
W80-04291

COORDINATION OF OVERLAPPING HIERARCHICAL WATER RESOURCES SYSTEMS,
Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
K. Sung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-168941, Price codes: A14 in paper copy, A01 in microfiche. PhD Dissertation, January 10, 1978. 319 p, 26 Fig, 11 Tab, 112 Ref, 3 Append. OWRT C-7047(No 6221)(3).

Descriptors: *Model studies, *Mathematical models, *Planning, *Water resources, *Optimization, Water utilization, Water resources development, Decision making, Management, Methodology, Synthesis, Theoretical analysis, Simulation analysis.

A multiobjective total system model approach to water resources planning was developed by combining three approaches to planning: the Surrogate Worth Trade-off (SWT) method, the TECHCOM approach, and the Utility Analysis approach. The SWT method, a quantitative approach, optimizes a mathematical analytical model by mathematical programming and interacts with decision makers. TECHCOM, a scenario approach, displays and analyzes information to reach the best solution for a large-scale complex system. Utility Analysis, a qualitative approach, interacts directly with decision makers to find preferences for different objectives. The multiobjective-hierarchical structure developed uses the utility approach to coordinate subsystems and hierarchical levels. SWT is used to generate a preferred solution at the highest level and then corresponding Pareto optimal solutions are subsequently determined at lower levels. Using this optimization structure many submodels are developed such as agricultural models, recreational development models, wildlife preservation models, and flooding control models. These models are used in an application of the SWT method to the Maumee River Basin Level-B Study. An analysis of the attributes of overlapping decomposition and coordination is given along with a comparison of the Dantzig-Wolfe decomposition. (Seigler-IPA)
W80-04292

A HIERARCHICAL MULTIOBJECTIVE METHOD FOR WATER RESOURCES PLANNING,
Case Western Reserve Univ., Cleveland, OH. School of Engineering.
S. C. Olenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-168966, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, May 31, 1978. 136 p, 7 Fig, 5 Tab, 44 Ref, 2 Append. OWRT-C-7047(No 6221)(5), 14-34-0001-6221.

Descriptors: *Model studies, *Mathematical models, *Planning, *Water resources, *Optimization, Water utilization, Water resources development, Decision making, Management, Methodology, Synthesis, Theoretical analysis, Simulation analysis.

Hierarchical multiobjective optimization was used in two approaches for the possible combination of the TECHCOM methodology and the Surrogate Worth Trade-off (SWT) methodology for use by decision-makers in water resources planning. TECHCOM has a hierarchical structure (goals, subgoals, social indicators, and action variables) that preserves information at all levels so that alternatives can be analyzed without the loss of lower level information. The SWT method, which solves the standard vector optimization problem where objectives are non-commensurable, can find a preferred solution by finding Pareto-optimal solutions and tradeoffs and using systematic decision-maker input. All that is needed to generate a preferred solution is decision-maker preference input. Two sample integrations of TECHCOM and SWT were tested on a sample problem using the Maumee River Basin Level-B land resources model. One alternative, the mathematical integration alterative integrates the SWT method within the information structure of the TECHCOM goal and subgoal hierarchy. The second alternative, the operational integration alternative, features an iterative process using TECHCOM and SWT in succession. Some of the requirements for use of the combined methodology are given. Usefulness of the combined methodology depends on the complexity of the hierarchy submodels. A major advantage of TECHCOM-SWT is that it eliminates the need for a priori preference information. (Seigler-IPA)
W80-04293

A PROPOSED GROUND WATER QUALITY MONITORING NETWORK FOR IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-04374

CONJUNCTIVE WATER USE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W80-04429

A REGULATED CITIZEN'S BILL OF RIGHTS,
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 6E.
W80-04466

6B. Evaluation Process

IMPROVEMENT OF THE QUALITY OF WASTE POND EFFLUENTS IN NORTHERN AREAS BY CHEMICAL PRE-PRECIPITATION,
Oulu Univ. (Finland). Water Research Lab.
For primary bibliographic entry see Field 5D.
W80-04287

HIERARCHICAL-MULTIOBJECTIVE APPROACH IN THE PLANNING AND MANAGEMENT OF WATER AND RELATED LAND RESOURCES,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Department.
For primary bibliographic entry see Field 5G.
W80-04291

CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES,
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.
L. M. Cowardin, V. Carter, F. C. Golet, and E. T. LaRoe.
Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. Stock No. GPO 024-010-00524-6. Biological Services Program Report No FWS/OBS - 79/31, December 1979. 110 p, 64 Fig, 5 Tab, 120 Ref, 5 Append.

Descriptors: *Classification, *Systematics, *Wetlands, *Wildlife, *Deep-water habitats, Aquatic habitats, Marshes, Estuarine environment, Rivers, Coasts, Aquatic animals, Plant populations, Wildlife habitats, Swamps, Bogs, Deepwater.

The hierarchical classification system used in the 1974 Fish and Wildlife Service inventory of wetlands and deepwater habitats in the United States is described and illustrated from a user oriented approach. The classification system is designed so that it provides uniformity of concepts and terms, and furnishes mapping units. At the highest level of classification five systems are defined: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Marine and Estuarine systems are divided into two subsystems, Subtidal and Intertidal; Riverine systems into four subsystems, Tidal, Lower Perennial, Upper Perennial, and Intermittent; Lacustrine systems into two, Littoral and Limnetic; while only Palustrine has no subsystem. Classes, within the subsystems, may appear under one or more of the systems or subsystems. These classes are based on substrate material and flooding regime, or on vegetative life form. Necessary for use of the system are the modifying terms applied to the classes or subclasses. Classes and modifying terms are listed. The lowest level of the classification hierarchy used is the dominance type which are named for the dominant plant or animal forms and must be developed by the user of the classification system. (Stiles-IPA)
W80-04301

GROUND WATER HEAT PUMPS - A COST COMPARISON,
Wilson (Ian D.) Associates Ltd., Barrie (Ontario).
D. Brown.
Canadian Water Well, Vol 6, No 1, p 20, February, 1980. 1 Fig.

Descriptors: *Heat pumps, *Ground water, *Cost comparison, Cost repayment, Costs, Fossil fuels,

Heating, Water wells, Pumping, Maintenance costs, Operating costs, Initial costs, Economics.

The ground water heat pump operates with a constant high efficiency or coefficient of performance (COP) because it taps a source of low-grade heat which is essentially unvariable. The cost of pumping water from a well to the heat pump will vary with water temperature, depth or distance to water, the particular model of heat pump used, and the amount of heat to be supplied. Although the ground water heat pump does cost more than conventional heating systems initially, the savings in operating and maintenance costs make it an economical alternative heating system for both new and old homes, especially with the high price of fuel. (Purdin-NWWA)
W80-04424

CONJUNCTIVE WATER USE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W80-04429

6D. Water Demand

THE POTENTIAL FOR DEVELOPING GROUND-WATER SUPPLIES IN THE PESCADERO AREA, SAN MATEO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. P. Akers.
Geological Survey Water-Resources Investigations 80-6, January 1980. 8 p, 1 Fig, 3 Ref.

Descriptors: *Groundwater, *Water resources development, *Water supply, *California, *Groundwater availability, Potable water, Water quality, *Pescadero area(Calif), *San Mateo County(Calif).

Adequate supplies of ground water for municipal use generally are not available within a 3-mile radius of Pescadero, San Mateo County, California. The required quantity of 100 gallons per minute probably could be obtained from one or more wells in the alluvium along Pescadero Creek; however, the quality of the water probably would deteriorate with time and might not be suitable for public supply for more than 20 or 30 years. Sand and gravel beds below 60 feet in the alluvium near the junction of Honsinger and Pescadero Creeks offer the best potential for developing domestic water supplies. (Kosco-USGS)
W80-04384

TOWARD THE MAXIMIZATION OF A RESOURCE: THE 1971 WASHINGTON WATER RESOURCES ACT,
For primary bibliographic entry see Field 6E.
W80-04480

6E. Water Law and Institutions

THE EVOLUTION OF WATER QUALITY MANAGEMENT, PART 3,
R. D. Hennigan.
Clearwaters, Vol 9, No 4, p 15-19, December 1979.

Descriptors: *Federal Water Pollution Control Act, *Water pollution control, *Federal legislation, Water permits, Water quality, Administration, Water management(Applied), Toxins, Pesticides, Environmental effects, Hazards, Water quality act.

Water quality management during the period 1972-1977 shifted to a national program of preservation and conservation. As the country got over Watergate, Vietnam, and other large concerns, more and more groups became alarmed about environmental issues. Water pollution became a pressing issue with major disasters such as the finding of PCBs in the Hudson River which resulted in a fishing ban, the dumping of Kepone in the James River, and the discovery of PCB's and Mirex in the Lake Ontario fishery. A high level of public response brought about Federal action mainly in the form of the Federal Water Pollution Control Act amendments (PL 92-500), one of the most complex and comprehensive measures ever enacted by Congress. The act applied to all United States waters and made the Environmental Protection Agency (EPA) the authority for implementing the act which was designed 'to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.' To implement the act various mechanisms were used such as four levels of planning, permits, construction grants, legal sanctions, and citizen action. Other acts were also implemented to help such as the Safe Drinking Water Act; Marine Protection, Research and Sanctuaries Act; Toxic Substances Control Act. The 1972 act had many deadlines for EPA that have since been revised. As a result of the act a great deal of improvement occurred in the Nation's waters. This progress continued as the era ended with the 1977 amendments to the original act. (Seigler-IPA)
W80-04303

NATIONAL WATER QUALITY INVENTORY 1976 REPORT TO CONGRESS.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5G.
W80-04459

GROUND WATER MANAGEMENT IN GEORGIA,
Georgia Univ., Athens. Legislative Research Div.
For primary bibliographic entry see Field 4B.
W80-04463

A REGULATED CITIZEN'S BILL OF RIGHTS,
National Oceanic and Atmospheric Administration, Washington, D.C.
R. R. Gardner.
Coastal Zone Management Journal, Vol 3, No 1, p 1-5, 1976.

Descriptors: *Public rights, *Water management(Applied), *Coasts, Water policy, Permits, Coastal engineering, Developed waters, State governments, Administrative agencies, Environmental control.

Coastal zone management has become a significant area of concern at all levels of government. In times of increasing environmental and economic progmatism, coastal management programs may be perceived as a function of big government and/or antithetical to development. In order to suceed in today's environment, coastal zone management programs need general public support. To ensure the support of the average citizen, each coastal zone management program should include in its policy statement the following points: (1) comprehensive, rational regulations that can be understood by the public; (2) simple regulatory procedures whereby regulated activity is not subjected to undue inconvenience; (3) reasonable costs of application; (4) timely decisions on applications within a time specified at the time of application; (5) negotiated settlements between applicants and the regulatory agency; (6) appeals from regulatory decisions; (7) equity of treatment; and (8) courteous treatment by all members of the regulatory body. (Wilson-Florida)
W80-04466

MINING RIGHTS AND THE GENERAL INTERNATIONAL LAW REGIME OF THE DEEP OCEAN FLOOR,
Syracuse Univ., NY.
L. F. E. Goldie.
Brooklyn Journal of International Law, Vol 2, No 1, p 1-69, Fall 1975.

Descriptors: *Law of the sea, *International law, *Resources development, United Nations, International commissions, Mining, Mineral industry, International waters, Legal aspects, Subsoil, Oceans, Usufructuary right.

The sessions of the Third Law of the Sea Conference have ended inconclusively, with no regime settled for the implementation of mining rights to the ocean floor. At present, customary international law provides for the taking of nodules from the high sea beds. While the high seas are common to all nations and cannot be appropriated, the wealth they contain can become the object of proprietorship. International law has developed only hazy concepts of possessory, usufructuary, and exclusive rights with respect to moveable property. Mining rights concepts, which enjoy acceptance in domestic law, were tried on the international level on the island of Spitybergen prior to the treaty of Paris. A similar kind of regime could emerge as a special seabed custom. The United Nations has declared a moratorium on exploitation of the ocean floor beyond the limits of national jurisdiction, pending the establishment of an international regime. The absence of any effective prohibitory rule for this resolution makes a clarification of mining rights of even more importance. (Wilson-Florida)
W80-04467

REMOTE SENSING EVIDENCE AND ENVIRONMENTAL LAW,
Rutgers-The State Univ., Newark, NJ. School of Law.
H. A. Latin, G. W. Tannehill, and R. E. White.
California Law Review, Vol 64, No 6, p 1300-1446, December 1976.

Descriptors: *Remote sensing, *Environmental control, *Monitoring, Legal aspects, Federal water pollution control act, Regulation, Strip mines, Administrative agencies, Water pollution, Reliability, Satellites(Artificial).

Remote sensing is the generic label applied to the technology designed to collect information about the earth's physical properties. The typical remote sensing application employs some form of aerial or satellite reconnaissance to measure and record environmental phenomena from a distance. To date, no accessible judicial or administrative opinion presents a comprehensive analysis of the utility and admissibility of remote sensing information. This information is relevant in the implementation of various natural resources and environmental programs. Two examples are in regard to the enforcement of water pollution controls, and in the control of strip mining. Remote sensory information can be utilized in investigatory and policy planning contexts, to determine conformance with regulatory standards and to document probable cause. In order for remote sensing output to be accepted in courts, the information must comply with formal rules of evidence. The submission strategy probably will parallel that employed for most types of scientific evidence. Thus the information will be in the form of expert testimony, and must pass basic legal tests for reliability. (Wilson-Florida)
W80-04468

A RECIPE FOR BAD WATER: WELFARE ECONOMICS AND NUISANCE LAW MIXED WELL,
Franklin Thomas Backus Law School, Cleveland, OH.
P. D. Junger.
Case Western Reserve Law Review, Vol 27, No 1, p 3-335, Fall 1976.

Descriptors: *Federal water pollution control act, *Economic impact, *Economic justification, Federal government, Legislation, Water pollution control, Legal aspects, Economic impact, Water quality, Ecology, Environmental control.

The 1972 Federal Water Pollution Control Act Amendments represent the first comprehensive modern attempt to achieve an effective scheme for water pollution control at the federal level. Passage of the Amendments and the increasing interest shown in interdisciplinary studies in law and economics suggest that lawyers will be confronted with the argument that implementation of the Amendments will be too costly. Under the doctrine of welfare economics, an optimal economic state can be reached, if the world behaved like an economic model of an efficient market. This theory should not apply to pollution control which is basically a moral question. The claim of excessive cost in cleaning our water cannot be ethically

or practically supported. Traditional nuisance law has been ineffective as a means of reducing water pollution. Nuisance law, both public and private, is a conflicting morass of doctrines which represents efforts to deal with individual situations rather than to provide clarity in defining legal rights. Failure to implement the Amendments will result in excessive water pollution, even if one accepts the premises of welfare economics. (Wilson-Florida)
W80-04469

DON'T LET POLITICS PROSCRIBE CLIMATIC RESEARCH,
Scripps Institution of Oceanography, La Jolla, CA.
W. A. Nierenberg.
Ceres, Vol 11, No 6, p 23-25, November-December, 1978.

Descriptors: *Research priorities, *International waters, *Weather forecasting, Weather data, Weather modification, Conferences, Fisheries, Research and development, International commissions, Climates, Climatic data.

Air-Sea Interaction, a new discipline, is being pursued by many nations worldwide. The ocean's role in climate change is important to understand, as such changes could have serious effects upon fishery resources. The Law of the Sea negotiations, begin in 1973, could have some bad effects in this area. The two major issues of this conference were ownership of fishery resources and mineral wealth. The former was rendered moot when Congress passed the Fisheries Conservation Act, giving United States fisheries control over a 200 mile contiguous zone. The latter issue will be surmounted when unilateral full-scale mining action is undertaken by a national company. The result of the negotiations could be an effort to restrict scientific research. Permission to conduct research must be obtained from the controlling nation and there is no method of appeal or arbitration. The negotiations must take a new direction and attempt to lighten political restraints on research. (Tabano-Florida)
W80-04470

THE PROTECTION OF HYDROLOGIC AND LAND PRESERVATION VALUES UNDER THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977: A WELCOME REFORM,
Appalachian Research and Defense Fund, Inc., Charleston, WV.
D. Wooley.
West Virginia Law Review, the National Coal Issue, Vol 81, No 4, p 627-670, 1979.

Descriptors: *Strip mining, *Strip mine wastes, *Surface runoff, *Soil conservation, Water pollution control, Land fills, Public rights, Sediment control, Land use, Government finance, Governmental interrelations, Hydrology.

The 1977 Surface Mining Control and Reclamation Act (Act) is evaluated in the context of West Virginia's 1971 Surface Mining and Reclamation Act. The federal Act is viewed as an improvement over state legislation in the following areas: (1) protection of hydrologic balance; (2) prevention of water contamination; (3) design of sediment ponds and water impoundments; and (4) conservation of topsoil and revegetation. Several land use considerations are also discussed in relation to the federal Act. The public participation aspects of the Act are outlined in a typical scenario. The Act should improve state enforcement mechanisms of strip mining laws, especially through financial assistance to upgrade the state programs. An interim program was put into effect while the state legislation was being upgraded. Problems arising between the state and federal agencies during this interim are briefly discussed. The fate of effective regulation is not good as the state has committed itself to the industry's view of the Act. The state and federal agencies must settle their differences in favor of effective implementation. (Tabano-Florida)
W80-04471

WATER QUALITY COMMITTEE-ANNUAL REVIEW OF SIGNIFICANT LEGISLATURE, JUDICIAL AND ADMINISTRATIVE, ACTIVITIES DURING 1977.
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 11, No 1, p 234-266, 1978.

Descriptors: *Water quality standards, *Water pollution control, *Administrative agencies, Legislation, Water quality, Federal Government, Judicial decisions, Effluents, Water law, Regulation.

In 1977, the federal courts rendered a large number of decisions interpreting provisions of the Federal Water Pollution Control Act (FWPCA). These cases involved the need for plans for pollution control under Section 208, review of effulent limitations and discharge permits, enforcement of the FWPCH requirements by the federal Environmental Protection Agency (EPA) and the citizens' groups and other issues involving private dischargers. Decisions dealing with the construction and funding of publically-owned treatment works are omitted. Significant EPA proposed regulations under the FWPCA, the Safe Drinking Water Act, and the Maine Protection, Research and Sanctuaries Act. These included National Secondary Drinking Water Regulations and regulations dealing with construction grants, effluent limitations, and toxic pollutant standards. Congress passed lengthy amendments to the FWPCA known as the Clean Water Act. Practically no major provision of FWCPA was left untouched. Changes were made to the construction grants program, Section 208 (water quality management and planning) requirements for industries, the control of toxic water pollutants, and Section 404 (the regulation of the discharge of dredged or fill material) among others. (Wilson-Florida)
W80-04472

DISPUTE SETTLEMENT IN THE LAW OF THE SEA CONVENTION: THE MILITARY ACTIVITIES EXCEPTION,
M. W. Janis.
Ocean Development and International Law Journal, Vol 4, No 1, p 51-65, 1977.

Descriptors: *Law of the sea, *Military aspects, *International law, Negotiations, Conferences, United nations, International commissions, Law enforcement, Legal aspects, Treaties.

The most concrete result of eight years of Law of the Sea negotiations is the Informal Single Negotiating Text. The Text consists of three substantive parts and a fourth part concerning dispute settlement. A party may ratify the Text but not accept some or all of the procedures for dispute settlement in specific categories. Article 18, Section 2(c) contains an exception to dispute settlement procedures concerning military activities, it being understood that law enforcement activities pursuant to the Law of the Sea Convention shall not be considered military activities. Military activities have been one of the maritime interests which the great powers have been particularly diligent in protecting. Although the exception seems to favor naval powers, in practice it would not. The emerging rules of the Law of the Sea are favorable to naval operations. It is more likely that the military activities exception would be used by coastal states resisting superpower naval activities. Thus the exception will remove activities from dispute settlement procedures which are almost certainly in need of peaceful resolution. (Wilson-Florida)
W80-04474

JURISDICTIONAL AND ADMINISTRATIVE LIMITATIONS AFFECTING MANAGEMENT OF THE HALIBUT FISHERY,
International Pacific Halibut Commission, Seattle, WA.
B. E. Skud.
Ocean Development and International Law Journal, Vol 4, No 2, p 121-142, 1977. 1 Tab, 32 Ref.

Descriptors: *United States, *Canada, *Fisheries, *International law, Fish, Fishing, Treaties, International commissions, Fish populations, Legislation, Foreign countries.

The International Pacific Halibut Commission, created by the 1923 Canadian-United States Halibut Convention, has managed the halibut fishery for these two countries for more than 50 years. Under the Convention and its subsequent revisions, the parties agreed among other things, to divide the waters into areas, to establish seasons, to limit catches, and make necessary regulations. The Convention has not been revised since 1953, and there is a question whether the Commission can effectively manage the fishery under existing guidelines. During the past 25 years, significant changes have occurred in the international fishery scene, with the extension of the fishery zone to 12 miles, and the imminent implementation of a 200-mile limit. National goals such as limited entry and optimum yield have not been incorporated in the terms of the existing Convention. These inconsistencies, as well as administrative deficiencies, have limited the effectiveness of the Commission. A revision of the present treaty and associated legislation is recommended. Suggestions are made for the restructuring of international arrangements now under study by the federal governments. A reference list is included. (Wilson-Florida)
W80-04475

THE IDAHO WATER PLAN: TWO THRESHOLD CONSTITUTIONAL PROBLEMS AND SUGGESTED SOLUTIONS,
Idaho Univ., Moscow.
D. L. Grant.
Idaho Law Review, Vol 15, No 3, p 443-507, Summer 1979.

Descriptors: *Idaho, *Water resources development, *Water management(Applied), Water resources, Water permits, Appropriation, Agencies, State governments, Water rights, Governmental interrelations, Constitutional Law.

The recent development of the Idaho water plan is a milestone in an ambitious state water resource development and management program. The development of a state water plan grew out of efforts by other western states and by the Department of the Interior to implement water programs which might direct Idaho's water resources. Two constitutional issues are of major importance in carrying out the Idaho plan. The first is one of intragovernmental relations, namely, the proper roles of the Idaho Legislation and the Idaho Water Resource Board in setting state water policy. The Idaho Constitution gives the Board power to implement a plan under such laws as may be prescribed by the legislature. Litigation has arisen over the extent of the Board's powers. The second issue involves the state's power to prohibit new appropriations which conflict with the objectives of the state water plan. The basic question is whether the disapproval of new appropriations on the ground of conflict with the public interest is contrary to the Idaho Constitution, which assures the right to appropriate waters. (Wilson-Florida).
W80-04476

NO WATER FOR THE WOODS: A CRITICAL ANALYSIS OF UNITED STATES V. NEW MEXICO,
California Univ., Berkley.
S. K. Fairfax, and A. D. Tarlock.
Idaho Law Review, Vol 15, No 3, p 509-554, Summer 1979.

Descriptors: *Forest management, *Federal-state water rights conflicts, *Water allocation(Policy), Water resources, Legal aspects, Land management, Federal reservations, Reclamation legislation, Judicial decisions.

United States v. New Mexico, decided in 1978, is the first Supreme Court opinion to confront directly the following questions: When may a federal land management agency assert the implied intent of Congress to reserve appurtenant water rights, when public land is withdrawn from entry. The majority of the Supreme Court decided that the Forest Service could not claim reserved rights for

the preservation of instream flows, recreation, and stockwatering. At issue was the implied intent of Congress in passing the 1891 Creative Act and the 1897 Organic Administration Act. An alternative reading of the two acts and other relevant legislation suggests that the 1891 Act authorizing forest reservations was intended to preserve the forests, and that the 1897 Act did not significantly alter the 1891 legislation. From this legislative interpretation, the Court's construction of the two acts is arguably wrong because the reservation of water for instream uses is consistent with the original reserve purposes. The decision also creates future federal-state water conflicts arising out of reserved right claims by federal land managers. (Wilson-Florida)
W80-04477

AN EQUITABLE REGIME FOR SEABED AND OCEAN SUBSOIL RESOURCES,
New York Univ., NY. Center for International Studies.
T. M. Franck, T. M. Kennedy, and C. V. Trinko.
Denver Journal of International Law and Policy, Vol 4, No 2, p 161-186, Fall 1974.

Descriptors: *Law of the sea, *International law, *Resources development, Oceans, United Nations, Treaties, Natural resources, Subsoil, International waters, Jurisdiction, Mining.

Ocean mineral resources are the world's last great new frontier in an era of massive mineral consumption and predictable mineral shortages. A strategy is needed for the implementation of an equitable regime for the allocation of the seabed and the ocean subsoil. The United Nations Seabed Committee has begun work drafting a treaty establishing an international regime for the exploitation of the seabed. This effort has been closely linked to the problem of defining the area subject to national jurisdiction. An equitable principle applicable to the seabed and subsoil can be formulated as follows: No state should be permitted to extend its jurisdiction over seabed and subsoil resources without sharing the benefits with the rest of the international community in accordance with each member's need. Revenue sharing, rather than a division of jurisdiction and multiplicity of operating authorities, has the advantage of simplicity and acceptability to coastal states. Advantages of an equitable sea regime include: (1) avoiding the potential conflict of a race for ocean space; (2) making international aid a multilateral undertaking; (3) establishing an international administration to protect the freedom of the high seas beyond national jurisdiction. (Wilson-Florida)
W80-04478

INTERNATIONAL RAMIFICATIONS OF THE FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976,
D. R. Christie.
Georgia Journal of International and Comparative Law, Vol 7, No 1, p 133-147, 1977.

Descriptors: *Law of the sea, *International law, *Marine fisheries, Fisheries, Conservation, Legislation, Foreign countries, International waters, United nations, Water law, Marine fish.

On April 13, 1976, President Ford signed the Fishery Conservation and Management Act (Act). This Act established a 200 mile fishery conservation zone over which the United States (U.S.) will exercise exclusive fishery management. The U.S. became the first major power to declare unilaterally a 200 mile exclusive fisheries zone. Many experts expressed doubts as to the legality of these exclusive zones under international law. Other issues to be faced by the U.S. in the implementation of the Act include: (1) prior treaty obligations and negotiations; (2) stress on relations with the Soviet Union, Japan and Latin America; (3) a rash of unilaterally declared zones which exceed the Fisheries Act; and (4) enforceability. The adoption of a 200 mile exclusive zone by the United States made unilateral extension an acceptable concept. The result has been a virtual 'sea-grab' by coastal nations. The successful extension of these zones may lessen the incentive to reach agreement at the Law of the Sea Conference. (Wilson-Florida)
W80-04479

TOWARD THE MAXIMIZATION OF A RESOURCE: THE 1971 WASHINGTON WATER RESOURCES ACT,
S. R. Pruzan.
Gonzaga Law Review, Vol 9, No 3, p 759-779, Spring 1974.

Descriptors: *Washington, *Water resources, *Water allocation(Policy), Base flow, Legislation, Hydrology, Water law, Administrative agencies, Riparian rights, Economics, Water conservation.

The 1971 Washington legislature enacted the Water Resources Act (Act). Under this legislation, the Washington State Department of Ecology must promulgate regulations to preserve and use water in a manner which will promote the 'public health and economic well being of the state and the preservation of its natural resources and aesthetic values.' The Act does not supersede the 1917 Water Code or other established legislation. The Act was needed because the improper use of water resources in Washington has led to a multitude of problems. To a great extent, pre-Act law, the lack of adequate hydrologic data, and the absence of sound economic theory are responsible for this inefficient use. Maximization of benefits under the Act will be established by base flow requirements, with ample consideration of recreation, fish and wildlife. Washington's allocation system will also be revamped. Maximum net benefits mean increased water transferability and the promulgation of regulations to protect purchases and encourage sales. (Wilson-Florida)
W80-04480

TRANS-BOUNDARY POLLUTION INJURIES: JURISDICTIONAL CONSIDERATIONS IN PRIVATE LITIGATION BETWEEN CANADA AND THE UNITED STATES,
S. C. McCaffrey.
California Western International Law Journal, Vol 3, No 2, p 191-259, May 1973.

Descriptors: *Water pollution effects, *Remedies, *Canada, *United States, Treaties, Legal aspects, Pollutants, International Joint Commission, Jurisdiction, International law, Boundaries(Surfaces).

Burgeoning industrialization in the past half-century has increased the probability that nations will injure each other through the medium of shared natural resources. Treating every private injury by trans-boundary pollution as an international tort will do little to further the .cause of harmony among nations. The importance of dealing with pollution problems regionally is well recognized, by tailoring specific preventive, regulatory or remedial measures to the air or watersheds concerned. Most natural resource problems arising along the Canadian-American boundary have been dealt with under the 1909 Boundary Waters Treaty or through the International Joint Commission which the Treaty created. Although air and water pollution problems have recently received much attention, the 1909 Treaty primarily focuses on navigation and diversion of waters. The Treaty does create private rights for extraterritorial injuries caused by diversion of water, but does not explicity address remedies for pollution injuries. The principal problem for plaintiffs suing under common law actions for injuries has been jurisdictional. The plaintiff must either sue in the defendant's country or encounter problems getting the defendent into court in the plaintiff's country. (Wilson-Florida)
W80-04481

COASTAL ZONE MANAGEMENT AND EXCLUDED FEDERAL LANDS: THE VIABILITY OF CONTINUED FEDERALISM IN THE MANAGEMENT OF FEDERAL COASTLANDS,
National Oceanic and Atmospheric Administration, Washington, DC.
M. E. Shapiro.
Ecology Law Quarterly, Vol 7, No 4, p 1011-1043, 1979.

Descriptors: *Federal-State Water Rights Conflicts, *Coasts, *Resources development, Legislation, State jurisdiction, Federal jurisdiction, Management, Water law, Administrative agencies, Water resources.

The 1979 Coastal Zone Management Act (CZMA) as amended authorizes a national program for the management, beneficial use, protection, and development of the natural resources in the nation's coastal zone. One goal of the Act is to encourage coastal states to exercise their full authority over the coastal zone resources. In defining coastal zone, Congress included a significant and controversial exception. Section 304(1) of the CZMA excludes from coastal zones those lands the use of which is subject to the discretion of or which is held in trust by the Federal Government. Many coastal states have argued that their ability to plan for and adequately manage their coastal resources has been seriously hampered by this exclusion of federal coastlands. However, under the federal consistency provisions of the CMZA, a state may influence management of federal coastlands to the extent federal land activities affect resources within the state's coastal zone. Federal agencies and the courts have differed over the interpretation of the relevant provisions of the Act. To ensure a viable, continuing federalism in the management of federal coastlines, the states must exercize their full range of powers in a manner that will both serve state goals and recognize the unique national interests associated with federal coastlines. (Wilson-Florida)
W80-04482

RECLAMATION LAW CONSTRAINTS ON ENERGY/INDUSTRIAL USES OF WESTERN WATER,
Environmental Defense Fund, Denver, CO.
G. W. Pring, and L. Edelman.
Natural Resources Lawyer, Vol 8, No 2, p 297-306, 1975.

Descriptors: *Reclamation, *Agricultural watersheds, *Water allocation(Policy), Energy, Agriculture, Industrial water, Water resources, Water policy, Administration, Resevoirs, Water demand.

The massive energy resources of the Western states have great potential for development. The various methods of energy conversion and transportation of energy resources will require enormous quantities of water - one of the region's scarcest resources. Even where available, water supply may quickly be exceeded by demand, creating conflicts between water needs for energy and for other uses, particularly agriculture. With increasing frequency, federal water storage projects are undergoing a changeover from agriculture to energy/industrial supply. As early as 1967, the Bureau of Reclamation began contracting to deliver large quantities of water to energy industries. However, there are legal constraints on western water use for energy. These limitations arise first under the federal reclamation laws. Bureau of Reclamation's authority to provide industrial water must be found both in the organic reclamation laws and within specific enabling legislation for the project from which the industrial water would be supplied. The apparent conflicts of existing law contain potential for legal challenge. These issues must be resolved before further contracting or delivering. The courts and the Congress should take the lead in this endeavor. (Wilson-Florida)
W80-04483

WATER QUALITY COMMITTEE (ANNUAL REVIEW OF ACTIVITIES - 1975).
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 9, No 2, p 311-318, 1976.

Descriptors: *Potable water, *Water quality standards, *Waste water(Pollution), Legislation, Public health, Water law, Water quality control, Judicial decisions, Effluents, Radioactive wastes.

In December, 1974, Congress passed the Safe Drinking Water Act (Act). Under this Act, the

federal Environmental Protection Agency (EPA) is directed to establish primary and secondary drinking water standards. The Act is applicable to public water systems, defined as a system for providing piped water with at least 15 service connections or for at least 25 individuals. Regulations are provided for state underground injection control programs which are of most concern to the oil and gas industry. The states are the primary enforcers of the Act. If the state has not developed an enforcement plan satisfactory to the administrator of the EPA, the administrator may take action. In 1975, approximately 400 court cases were filed concerning the interpretation of the Act's provisions. The issues dealt with by the more significant decisions included: (1) effluent limitations; (2) thermal discharge variances; (3) toxic substances and pre-treatment standards; (4) the NPDES permit program; (5) dredge and fill permit program; (6) areawide waste management planning; (7) regulation of radioactive waste discharges; and (8) construction grants program. (Wilson-Florida)
W80-04484

NOAA'S MARINE SANCTUARY PROGRAM,
National Oceanic and Atmospheric Administration, Rockville, MD. Coastal Zone Management Office.
R. R. Kifer.
Coastal Zone Management Journal, Vol 2, No 2, p 177-188, 1975.

Descriptors: *Wildlife management, *Federal project policy, *Preservation, Coasts, Legislation, Protection, Water law, Marine animals, Federal jurisdiction, Oceans, Environmental effects.

Authority to designate marine sanctuaries was established by Title III of the 1972 Marine Protection, Research, and Sanctuaries Act (Act), as the ocean water counterpart to our National Parks and Seashores. Responsibility for implementing the marine sanctuary program was delegated to the Office of Coastal Zone Management (OCZM) of the National Oceanic and Atmospheric Administration. A sanctuary may have a designation in any of the following areas: (1) habitats; (2) species; (3) recreational and aesthetic; (4) research; and (5) unique. A nomination for marine sanctuary designation may come from any individual, organization, or governmental body. A nomination is processed by the OCZM with public participation. The Act requires consultation with both state and federal agencies. An environmental impact statement is also required. The process culminates in sanctuary designation. The day-to-day operations of the sanctuary are covered in part by the Act, including both surviellance and protection. The Act provides for prosecution of violators. (Wilson-Florida)
W80-04485

THE WINTERS DOCTRINE ON RESERVED WATER RIGHTS IN IDAHO: AVONDALE IRRIGATION DISTRICT V. NORTH IDAHO PROPERTIES, INC.,
B. Palmer.
Idaho Law Review, Vol 15, No 3, p 591-603, Summer 1979.

Descriptors: *Idaho, *Reservation doctrine, *National forests, *Federal-state water rights conflicts, Federal reservations, Wildlife conservation, Fish conservation, Legislation, Natural resources, Indian reservations, Water allocation(Policy).

This note concerns two recent cases which addressed questions relating to federal reserved water rights on national forest land in Idaho. At issue was whether Idaho law required the federal government to specifically quantify its water needs for national forest purposes, and if so, whether reservation of the entire natural flow of streams in national forests was specific enough quantification to satisfy that requirement. Both cases involved the application of the Winters Doctrine. Under this doctrine, whenever the federal government reserves land from the public domain, it also impliedly reserves rights to water not previously appropriated which is necessary for the fulfillment of its purpose of the reservation. The Idaho Supreme Court concluded that the reservation of water for forests in each case was specifically reserved for the limited purposes of 'preserving a perpetual supply of timber and protecting watersheds to secure favorable conditions of water flows.' Fish and wildlife preservation, recreation, and aesthetics were found not to be proper purposes for reserving water for national forest land. Federal water rights under the specific quantification statute must fall within the limited defined purposes. (Schwerer-Florida)
W80-04486

IMPACT OF THE 1977 CLEAN WATER ACT AMENDMENTS ON INDUSTRIAL DISCHARGERS,
Morgan, Lewis and Bockius, Washington, DC.
J. Quarles.
Environmental Reporter, Vol 8, No 46, Monograph No 25, March 17, 1978. 12 p.

Descriptors: *Waste water treatment, *Water quality standards, *Federal Water Pollution Control Act, *Industrial plants, Waste water, Pollutants, Discharge(Water), Water pollution control, Legislation, Water pollution sources, Regulation, Administrative agencies.

The 1977 Clean Water Act (1977 Act) comprehensively amended the 1972 Federal Water Pollution Control Act. Under the 1977 Act companies not in compliance with the 1977 requirements may obtain a limited extension of the compliance deadline. The 1977 Act substantially revises the standards for best available technology control, previously scheduled for completion by 1983. Variances from the requirements for control of nonconventional pollutants are permitted under specified conditions. The regulatory framework is expanded by authorizing the federal Environmental Protection Agency to issue regulations to control and restrict the runoff of toxic and hazardous materials. Provisions for noncompliance fees were not included in the legislation as finally enacted. The pretreatment requirements are modified to provide discharges credit for any removal of toxic pollutants by a municipal sewage treatment plant. As a consequence of this prospect, companies may wish to reconsider the advantages of tieing into a municipal system. (Wilson-Florida)
W80-04487

DEMORALIZED WETLANDS OWNERS: IS THERE JUST COMPENSATION AFTER BRECCIAROLI V. CONNECTICUT COMMISSIONER OF ENVIRONMENTAL PROTECTION.,
R. W. Reeves.
Connecticut Bar Journal, Vol 53, No 1, p 60-72, February 1979.

Descriptors: *Wetlands, *Connecticut, *Legislation, *Land use, Judicial decisions, Regulation, Environmental control, State governments, Water law, Tidal marshes, Administrative agencies.

In 1971, the Connecticut Commissioner of Environmental Protection designated as tidal wetlands property owned by Dante Brecciaroli. The statutory authority for the action was the Tidal Wetlands Act. This is one of two Connecticut statutes dealing with the preservation of wetlands, the other is the Inland Wetlands Act. Under either act an owner of property designated as wetlands can conduct no 'regulated activity' on the property without a permit. This term essentially encompasses all those uses which an average landowner might want to conduct on his land. Mr. Brecciaroli applied to the Commissioner for a permit to fill-in 5.3 acres of the wetland area. Following a hearing, this application was denied, this judgment being affirmed by the Connecticut Supreme Court. The Brecciaroli decision exemplifies a weakness in the wetlands regulatory scheme: an ever-increasing procedural burden is placed upon owners of wetlands who desire to conduct some reasonable use on their properties. The decision also raises the question of when and how a landowner ought to be compensated for the effects of land-use regulation. (Wilson-Florida)
W80-04488

OIL SPILLS - STATE PREVENTION AND THE POSSIBILITY OF PRE-EMPTION,
S. R. Armstrong.
Mercer Law Review, Vol 30, No 2, p 559-572, Winter 1979.

Descriptors: *Washington, *Oil spills, *Water pollution control, Federal government, Environment, Environment controls, Legislation, Shore protection, Coasts, Oil, Transportation.

The likelihood of oil spills and related accidents has caused concern to coastal states. A state legislature's problems in seeking to balance energy demands with environmental concerns are complicated by federal environmental regulation. Confronting these conflicting interests the Washington State Legislature passed the 1975 Washington Tanker Law (Act). A case challenging the constitutionality of that law, Ray v. Atlantic Richfield Co. (Ray) is analyzed. The development of the doctrine of federal pre-emption is discussed. The use of the doctrine of federal pre-emption in the Ray case is examined. The court's ruling invalidated certain provisions of the Act - the pilot licensing and the safety and design features among others, but upheld other provisions. There is a discussion of alternative methods of balancing the need for energy against the potential hazards of oil transportation. Among the alternatives discussed are state acts which protect the environment by providing for damages after-the-fact. This would protect a state's environment while avoiding the chances of federal pre-emption. (Daniels-Florida)
W80-04489

THE IRRIGATION REVOLUTION AND ITS ENVIRONMENTAL CONSEQUENCES,
J. Aucoin.
Environment, Vol 21, No 8, p 17-20, 38-40, October 1979.

Descriptors: *Nebraska, *Irrigation systems, *Erosion, *Groundwater recharge, Water table, Water quality, Water pollution, Environmental effects, Groundwater, Groundwater availability, Water resources, Irrigation.

The center pivot irrigation system is examined as to its good features and the environmental consequences for its use. The effect of this system in Nebraska is emphasized. The advantages over other systems are briefly discussed. About a third of the irrigated acres in Nebraska are serviced by center pivot systems and this percentage is growing. The problems associated with this increase in acreage serviced by this system are analyzed. These include land erosion and a vanishing water table. Actions taken to combat these growing problems are discussed. Related to the water quantity questions are the problems of water quality. Pollution of groundwater associated with use and reuse of the same water is explored. Conflict of interests between local communities benefited by the increase in center pivot irrigation system's use and state officials and environmentalists are discussed. Whether Nebraska and other plains states can avoid destruction of their necessary resources is still unresolved. (Daniels-Florida)
W80-04490

PRESCRIPTIVE ADMINISTRATIVE PROPOSAL: AN INTERNATIONAL MACHINERY FOR CONTROL OF THE HIGH SEAS,
Virginia Univ., Charlottesville. Inst. of Government.
N. D. Joyner, and C. C. Joyner.
International Lawyer (A.B.A.), Vol 8, No 1, p 57-73, January 1974.

Descriptors: *Inter-agency cooperation, *International law, *Fisheries, Administration, Administrative agencies, United Nations, Coordination, International waters, Fishing, Oceans, Administrative decisions.

An administrative model for international control of the high seas is proposed. Increasing reliance on resources from the sea, especially fish, present reasons for encouraging international cooperation in regulating fisheries on the high seas. The history of

international administrative control over this area is examined. There is a brief summary of the ocean-related functions of seven major United Nations agencies (U.N.) whose organizational goals include a concern for research and development of the ocean environment on an international level. An analysis of the hierarchy of United Nation's functional agencies is included. Prescriptive proposals for the reorganization of the U.N. marine-oriented agencies are presented, with an explanation of the proposed hierarchy for international high seas control. Methods to expedite international control of the high seas are briefly discussed. To be successful, the proposed administrative machinery for control of the high seas requires: (1) rational analysis of the framework of existing U.N. marine-oriented agencies; and (2) a realization of the realities of international power politics combined with existing modes of coping with marine environmental problems. (Daniels-Florida)
W80-04491

MODEL COASTAL ZONE STATUTE,
N. Smith, P. Ratner, and A. MacBeth.
Coastal Zone Management Journal, Vol 1, No 2, p 209-225, Winter 1974.

Descriptors: *Zoning, *Coasts, *Shore protection, *Model studies, Resources development, Permits, Programs, Planning, Legal aspects, State governments, Natural resources, Conservation.

This model coastal zone management statute provides a possible state response to the federal 1972 Coastal Zone Management Act. The statute is designed to provide a general plan conforming to specific requirements of the federal Act which may be adapted to specific requirements of individual states. The model statute was written with the intention that all or parts of it could be adapted to the wide variety of state regulatory schemes with the aim of providing unitary management. A Coastal Zone Commission is created with a two-part jurisdiction consisting of the shore area and the larger coastal zone. The Commission will plan, regulate and assume certain functions of existing state agencies, with final responsibility for authorizing development within the coastal zone. Centralized control is a major promise of the statute. The Commission must prepare a coastal zone plan, which will serve as a basis for zoning and permit regulation. Once the plan is in effect, a permanent system of regulation reflecting a different balance of interests for the shore area and the larger coastal zone will be established. (Daniels-Florida)
W80-04492

SOCIAL EQUITY IN COASTAL ZONE PLANNING,
California Univ., Berkley.
T. Dickert, and J. Sorensen.
Coastal Zone Management Journal, Vol 1, No 2, p 141-150, Winter 1974. 1 Tab.

Descriptors: *Coasts, *Zoning, *Decision making, *Social impact, Equity, Social values, Resources, Standards, Resource allocation, Resource development, Land use.

A list is presented of social-economic impacts that coastal zone decision-makers should consider, either when developing coastal policies or when reviewing proposed projects in the coastal zone. A checklist is developed to relate the socio-economic impacts identified to information and methods necessary for impact assessment. The present emphasis of coastal planning on environmental protection and economic development fails to give broader consideration to social equity and social values. This inadequate consideration of social values means many policies developed for environmental protection or economic development of coastal resources may be socially regressive. The objectives of most coastal planning programs are listed. Problems are outlined which will be encountered in the attempt to include social equity considerations in coastal planning. A process is offered which can provide for the consideration of social impacts in a coastal planning program and resolve some of the problems outlined. (Daniels-Florida)
W80-04493

COASTAL STATES ORGANIZATION: THE PAST AND FUTURE,
Coastal States Organization, Charleston, SC.
J. A. Timmerman, Jr.
Coastal Zone Management Journal, Vol 1, No 1, p 119-122, Fall 1973.

Descriptors: *State governments, *Shore protection, *Coasts, Federal government, Resources development, Conferences, Organization, Oceanography, Legislation, Research and development.

A major recommendation of the Stratton Commission to the President in 1968 called for the federal government and the coastal states to collectively create a mechanism to better manage their coastal resources. In November 1968, the first conference ever held among the maritime states was convened in Miami by the Governor of Florida and the Florida Commission on Marine Sciences and Technology. Another meeting was held by representatives of 22 coastal states in Savannah, Georgia in 1970. At this meeting provisional articles of organization were drawn up and a resolution was passed recommending the articles be submitted to the respective states for adoption. The Coastal States Organization (CSO) is open to those states or commonwealths having an ocean, gulf, or Great Lakes Boundary. Among its responsibilities, the CSO contributes to the development of common policy regarding national coastal management legislation and programs. Its major accomplishment to date has been aiding the passage of the 1972 Federal Coastal Zone Management Act. CSO's primary aim for the future should be to focus attention on the National Coastal Zone Management Program and Coastal Zone Research and Technical Services Program. (Wilson-Florida)
W80-04494

ENVIRONMENTAL PROTECTION MOTIVATION IN COASTAL ZONE LAND-USE LEGISLATION,
Conservation Foundation, Washington, DC.
S. Zwicky, and J. Clark.
Coastal Zone Management Journal, Vol 1, No 1, p 103-108, Fall 1973.

Descriptors: *Shore protection, *Land use, *Coasts, *Land development, Flood plains, Wetlands, Legislation, Environmental control, Land management, State governments, Ecosystems, Coastal plains.

The coastal environment is particularly sensitive to the adverse impacts of development. Recognizing that traditional land controls do not provide the needed coastal zone protection, many states have enacted special land-use legislation aimed in part at preserving natural values in coastal areas. Seventeen of the 30 coastal states have substantive coastal zone land protection laws. The four purposes cited most frequently among laws of these 17 states were: (1) protection of wildlife and fisheries; (2) protection of ecosystems or the natural environment; (3) control of development; and (4) enhancement of aesthetic values. Other purposes included: protection of life and property, enhancement of public recreation, soil conservation, and protection of water resources. Development and economic purposes were cited in relatively few laws. The 1972 Coastal Zone Management Act establishes federal policy, authorizes federal assistance to states for developing programs of coastal zone land use control and provides for state approval of federal projects in the coastal zone. (Wilson-Florida)
W80-04495

THE EMERGENCY POWERS IN THE ENVIRONMENTAL PROTECTION STATUTES: A SUGGESTION FOR A UNIFIED EMERGENCY PROVISION,
R. B. Skaff.
The Harvard Environmental Law Review, Vol 3, p 298-325, 1979.

Descriptors: *Pollution abatement, *Environmental control, *Federal Water Pollution Control Act, Protection, Governmental interrelations, Government finance, Administrative agencies, Administrative decisions, Judicial decisions, Remedies.

The emergency powers of the Clean Water Act, the Safe Drinking Water Act, the Clean Air Act, and the 1976 Resource Conservation and Recovery Act are evaluated. A short history of these powers is presented, emphasizing two periods of legislation. The first was characterized by civil remedy provisions. The second by other emergency enforcement options. This is followed by a brief overview of the discretionary powers. Several major themes of the various acts are presented and analyzed: (1) the varying scope of protection; (2) interaction with state and local authorities; (3) the 'imminent and substantial endangerment' standard, including a lengthy discussion of civil actions and the meaning and application of the standard; (4) other remedies; (5) administrative orders; and (6) the funded emergency assistance program. The emergency powers are an effective bargaining tool for obtaining action from state and local governments and individual polluters. It is suggested that the separate provisions be unified under a single provision to reduce the administrative and judicial burden of interpretation and to provide a more efficient legal authority. (Tabano-Florida)
W80-04496

THE FUTURE OF SCIENTIFIC RESEARCH IN CONTIGUOUS RESOURCE ZONES: LEGAL ASPECTS,
J. R. Moore.
International Lawyer (A.B.A.), Vol 8, No 2, p 242-261, April 1974.

Descriptors: *International law, *Research and development, *Oceans, Legal aspects, Treaties, Resources, International waters, United Nations, Conferences, Coasts, Regime.

Scientific research in contiguous resource zones has been a growing practice of nations, to claim jurisdiction over ocean resources within 200 miles of their coasts. Coastal states claim exclusive or preferential resource jurisdiction. The legal status of scientific research in these zones is unsettled. The historical practices of states' scientific research in the oceans are briefly examined. The current state of the law with regard to scientific research in contiguous zones is explored. Four basic problems in defining the legality of research near coastal waters are examined. In assessing the future of scientific research in contiguous zones, the political climate out of which agreements controling such research must come is discussed. The new international law on scientific research should be in the form of a separate and distinct convention on Marine Scientific Research. Considerations, which the convention drafters should consider are outlined. Suggested are a basic structure for the convention and two provisions of the convention, one dealing with notice, and another regarding participation by coastal states. (Daniels-Florida)
W80-04497

AN INTERNATIONAL COMPARISON OF TRENDS IN WATER RESOURCES MANAGEMENT,
Fordham Univ., Bronx, NY. School of Law.
L. A. Teclaff.
Ecology Law Quarterly, Vol 7, No 4, p 881-915, 1979.

Descriptors: *Comparative benefits, *Water resources development, *Preferences(Water rights), Management, Legal aspects, Reclaimed water, Conjunctive use, Economic efficiency, Water supply, Waste water treatment, Use rates.

Efficient water use has become a major goal of modern water management. The various administrative policies used by legal regimes internationally to encourage conservation, recovery, and reuse of water are evaluated. Developing a comprehensive and consolidated administrative system of water law is the current goal of most water codes. Modern water legislation not only subjects all water to a single regulatory structure, but also includes all uses, whether old or new, under that system. In conjunction with the current trend in water resources management, such concepts as pre-existing uses, preference of use, qualified water rights, pricing systems, recycled water, and con-

junctive use are compared. As worldwide demand for water steadily grows, it is increasingly important that the legal rules governing the management and utilization of water resources actively promote, rather than impede, efficiency in water use. This basic policy goal is evaluated and examined. Possible methods of implementation are suggested. (Schwerer-Florida)
W80-04498

FEDERAL COMMON LAW: JUDICIALLY ESTABLISHED EFFLUENT STANDARDS AS A REMEDY IN FEDERAL NUISANCE ACTIONS,
D. Leybold.
Boston College Environmental Affairs Law Review, Vol 7, No 2, p 293-315, 1978.

Descriptors: *Wisconsin, *Illinois, *Water quality standards, *Water pollution control, Sewage disposal, Federal government, Federal jurisdiction, Judicial decisions, State governments, Water pollution, Legal aspects.

The United States Supreme Court, in Illinois v. City of Milwaukee, revitalized the federal common law of nuisance by ruling that certain suits, alleging that water pollution created a public nuisance, could be heard in federal courts on the basis of federal law. The United States District Court for the Northern District of Illinois, which subsequently heard the case on its merits, made its rulings under the federal common law of nuisance. The district court found that Milwaukee's sewage discharge into Lake Michigan created a nuisance, and ordered Milwaukee to comply with specific court-established effluent standards. The Supreme Court's decision formally added nuisance law, as applied to interstate navigable waters, to the list of substantive areas governed by federal common law. The district court's ruling is consistent with federal common law principles; if the court's standards are seen as findings of fact aimed only at limiting the activities which created the nuisance. Such a holding protects Illinois' sovereign right not to be subjected to outside nuisance. (Wilson-Florida)
W80-04499

NONPOINT POLLUTION CONTROL IN VIRGINIA,
J. V. Cogbill, III.
University of Richmond Law Review, Vol 13, No 3, p 539-556, Spring 1979.

Descriptors: *Virginia, *Urban runoff, *Agricultural runoff, *Water pollution control, Pollutants, Legislation, Soil erosion, Waste, Identification, Federal Water Pollution Control Act, Pesticides, Water pollution sources, Water law.

Nonpoint pollution includes soil erosion from agricultural, silvicultural, and mining sources, as well as urban runoff. Soil erosion is the major pollution threat, carrying the pesticides, fungicides, rodenticides, nutrients placed in the soil, and other contaminants used or created by land use. In Virginia, nonpoint pollution is presently uncontrolled and a threat to the marine environment. In 1972 Congress enacted the Federal Water Pollution Control Act. The discharge control mechanism was articulated in section 402 as the National Pollution Discharge System, establishing a permit program to impose effluent limitations. The states were primarily responsible for implementation. The 1977 Clean Water Act (1977 Act) presented a stronger and clearer direction for states to identify and control sources of nonpoint pollution. Section 208 of the 1977 Act provides that each state develop areawide planning to control such pollution sources as agriculture, silviculture, mining and urban runoff. In Virginia, the State Water Control Board began implementation of a state waste management plan. Virginia relies on voluntary participation by agricultural nonpoint source polluters. A more affirmative role by the state is needed. (Wilson-Florida)
W80-04500

6F. Nonstructural Alternatives

ENVIRONMENTAL PROTECTION MOTIVATION IN COASTAL ZONE LAND-USE LEGISLATION,
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04495

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL MANAGEMENT OF MULTIPURPOSE RESERVOIRS SUBJECT TO FLUCTUATING FLOOD POOLS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Austin, R. Q. Landers, and M. D. Dougal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-164205, Price codes: A10 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University Technical Completion Report No ISWRRI-84, ISU-ERI-AMES 79238, June 1979. 210 p, 52 Fig, 29 Tab, 27 Ref, 1 Append. OWRT B-049-IA (4).

Descriptors: *Reservoir operation, *Flood control, *Mathematical models, *Shore protection, Iowa, Vegetation effects, Erosion control, Soil conservation, Flood damage, Reservoir releases, Succession, Trees, Forest management, Vegetation regrowth.

Mathematical models were developed and used to simulate the effect of fluctuating water levels in multipurpose reservoirs in Iowa. The models are designed as management and operational tools to evaluate trade-offs between the environmental impacts in the flood pool upstream of the dam and the economic benefits downstream of the dam. The Saylorville Reservoir located on the Des Moines River was used for the study because it periodically inundates an environmentally sensitive and scenic area in the Ledges State Park, one of the area's most popular recreational parks. A dynamic programming optimization model was developed to select the optimal operating policy for the reservoir. The model is forward looking and has only a single decision variable, the release rate from the reservoir. State incremental or discrete differential solution algorithms are not needed as the number of discrete states used is not excessive. The 10 largest historical floods were input to determine the operating policy which best minimizes damages. Also used were a reservoir routing model and a vegetative succession model. The vegetative model simulated general vegetative responses to flooding but it does not give precise results for specific sites. The lower areas of Ledges State Park will be heavily impacted by high reservoir water levels and extensive cleanup will be needed after each inundation. Five vegetative zones were defined for degree of damage and various techniques for mitigation are recommended. (Seigler-IPA)
W80-04204

HIERARCHICAL-MULTIOBJECTIVE APPROACH IN THE PLANNING AND MANAGEMENT OF WATER AND RELATED LAND RESOURCES,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Department.
For primary bibliographic entry see Field 5G.
W80-04291

NOAA'S MARINE SANCTUARY PROGRAM,
National Oceanic and Atmospheric Administration, Rockville, MD. Coastal Zone Management Office.
For primary bibliographic entry see Field 6E.
W80-04485

DEMORALIZED WETLANDS OWNERS: IS THERE JUST COMPENSATION AFTER BRECIAROLI V. CONNECTICUT COMMISSIONER OF ENVIRONMENTAL PROTECTION,,
For primary bibliographic entry see Field 6E.
W80-04488

THE IRRIGATION REVOLUTION AND ITS ENVIRONMENTAL CONSEQUENCES,
For primary bibliographic entry see Field 6E.
W80-04490

ENVIRONMENTAL PROTECTION MOTIVATION IN COASTAL ZONE LAND-USE LEGISLATION,
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04495

7. RESOURCES DATA

7A. Network Design

A PROPOSED GROUND WATER QUALITY MONITORING NETWORK FOR IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. L. Whitehead, and D. J. Parliman.
Geological Survey open-file report 79-1477 (WRI), October 1979. 67 p, 10 Fig, 22 Tab, 25 Ref.

Descriptors: *Groundwater, *Water quality, *Monitoring, *Observation wells, *Network design, Idaho, Hydrologic data, Aquifers, River basins, Model studies, Groundwater movement, Groundwater recharge, Base flow, Water pollution sources, Sampling, Sites, Water analysis, Planning, Evaluation, Data collections, Data storage and retrieval, *Watstore.

A ground water quality monitoring network is proposed for Idaho. The network comprises 565 sites, 8 of which will require construction of new wells. Frequencies of sampling at the different sites are assigned at quarterly, semiannual, annual, and 5 years. Selected characteristics of the water will be monitored by both laboratory- and field-analysis methods. The network is designed to: (1) Enable water managers to keep abreast of the general quality of the State's ground water, and (2) serve as a warning system for undesirable changes in ground-water quality. Data were compiled for hydrogeologic conditions, ground-water quality, cultural elements, and pollution sources. A 'hydrologic unit priority index' is used to rank 84 hydrologic units (river basins or segments of river basins) of the State for monitoring according to pollution potential. Emphasis for selection of monitoring sites is placed on the 15 highest ranked units. The potential for pollution is greatest in areas of privately owned agricultural land. Other areas of pollution potential are residential development, mining and related processes, and hazardous waste disposal. Data are given for laboratory and field analyses, number of site visits, manpower, subsistence, and mileage, from which costs for implementing the network can be estimated. Suggestions are made for data storage and retrieval and for reporting changes in water quality. (Kosco-USGS)
W80-04374

7B. Data Acquisition

AUTOMATIC MEASUREMENT OF SOIL-WATER PRESSURE USING A CAPACITANCE MANOMETER,
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique de Grenoble.
J. L. Thony, and G. Vachaud.
Journal of Hydrology, Vol 46, No 1/2, p 189-196, March 1980. 5 Fig, 4 Ref.

Descriptors: *Soil water, *Pore pressure, *Measurement, *Instrumentation, *Capacitors, *Pressure measuring instruments, Manometers, Soil profiles, Infiltration, Calibrations, Electrical equipment, Patents, Capacitance manometers, Pressure transducers.

A new, cheap, and reliable pressure transducer has been developed. It is based on the use of a mercury manometer with the outer face of the glass tubing covered with a transparent metallic oxide. This acts as the fixed outer electrode of a capacitor, of which the capacitance linearly changes with the position of the mercury in the tube. This pressure transducer can be linked with an automatic recording device. Examples were given of the field use of a series of these transducers in which they were coupled to tensiometers in a natural water-balance study. (Visocky-ISWS)
W80-04305

A NEW TECHNIQUE FOR MEASURING TIDAL CURRENTS BY USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
A. S. Frisch, and B. L. Weber.
Journal of Geophysical Research, Vol 85, No C1, p 485-493, January 20, 1980. 10 Fig, 1 Tab, 13 Ref.

Descriptors: *Currents(Water), *Tidal waters, *Tidal effects, *Radar, *Alaska, Remote sensing, Tides, Circulation, Water circulation, Ocean circulation, Ocean currents, Bays, Coasts, Data processing, Spatial distribution, Analytical techniques, *Cook Inlet(AK), Tidal currents, Doppler radar.

Surface currents were measured by using a newly developed high-frequency (HF) Doppler radar technique. The system was operated in lower Cook Inlet, Alaska, in July 1977. During one particular day, July 13, radar data collected every 30 min for 24 hours was analyzed. By least squares fitting these data to two of the dominant tidal periods, 12.31 and 24.6 hours, the spatial distribution of the tidal currents for each of these two periods was determined. In addition, the spatial distribution of the mean surface currents for this 24-hour period was analyzed. Analysis of this data showed that near Kachemak Bay there is a distinct difference of the east-west component of tidal flow in comparison with regions further from Kachemak. In addition, longer period components were observed for which the period could not be determined. These components exhibited gyrelike spatial patterns. Results demonstrated the use of HF radar techniques for resolving spatial and temporal currents which affect the nearshore environment. (Sims-ISWS)
W80-04307

SYMPOSIUM ON GLACIER BEDS: THE ICE-ROCK INTERFACE.
For primary bibliographic entry see Field 2C.
W80-04313

DEPOLARIZATION OF RADIO WAVES CAN DISTINGUISH BETWEEN FLOATING AND GROUNDED ICE SHEETS,
Natural Environment Research Council, Cambridge (England). British Antarctic Survey.
For primary bibliographic entry see Field 2C.
W80-04328

A SIMPLE TUBULAR PHYTOPLANKTON SAMPLER FOR VERTICAL PROFILING IN LAKES,
Ontario Ministry of the Environment, Ottawa. Water Resources Branch.
K. H. Nicholls.
Freshwater Biology, Vol 9, No 2, p 85-89, April 1979. 2 Fig, 7 Ref.

Descriptors: *Phytoplankton, *Equipment, *Water sampling, Buckskin Lake, Ontario, Tadenac Lake, Sampling, Depth, Materials, Testing procedures, Water analysis, Lakes, Data collections, Biomass, Algae, Epilimnion, Hypolimnion, Canada.

This paper describes a tubular phytoplankton sampler which offers versatility not available in other samplers and which is simply and inexpensively constructed. By pooling samples from a 2 m or 3 m tube, a composite sample of any selected depth interval can be obtained. The sampler consists of a tube with an exterior valve mechanism at the lower end which opens when the sampler is lowered and closes when it is raised. A capping plate at the top opens the tube to lakewater passing through it during descent and closes off the top when the tube travels upward to the lake surface. Opening and closing is activated by water pressure exerted on two exterior vanes, avoiding a messenger-activated closing mechanism. The new sampler collected phytoplankton from Buckskin and Tadenac Lakes, Ontario, August 1977. In each lake, maximum phytoplankton density was not in the epilimnion but in the metalimnion or upper hypolimnion. In both lakes, certain chrysophytes had distinctly higher densities below the epilimnion. (Danovich-Wisconsin)
W80-04344

7C. Evaluation, Processing and Publication

EFFECT OF AGRICULTURE ON CEDAR LAKE WATER QUALITY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-04206

STAINING PREPARATIONS FOR PHYTOPLANKTON AND PERIPHYTON,
NUS Corp., Pittsburgh, PA. Ecological Sciences Div.
B. B. Owen, Jr., M. Afzal, and W. R. Cody.
British Phycological Journal, Vol 13, No 2, p 155-160, June 1978. 3 Tab, 10 Ref.

Descriptors: *Phytoplankton, *Analytical techniques, *Methodology, *Dyes, *Periphyton, Diatoms, Cytological studies, Algae, Testing procedures, Biomass, Biological communities, Microscopy, Testing, Evaluation, Water analysis, Laboratory tests.

Phytoplankton and periphyton can be studied on the same slides by staining preserved samples with acid fuchsin, dehydrating them and then preparing membrane-filter (phytoplankton) or slurry (periphyton) microscope mounts. The methods provide a single preparation procedure for phytoplankton or periphyton samples, allowing investigators to study diatom and non-diatom components in detail and to distinguish diatoms alive at collection from those already dead, based on visible cell contents. The ability to distinguish between live and dead diatoms provides information more ecologically meaningful than that generated by methods based upon cleaned diatom studies. Procedures described in this result mostly from excessive filtration vacuum rather than from loss of material during preparation. However, no significant differences occur in ratios of live, dead, and broken diatoms after sample preparation by wet mounts, centrifuging or sedimentation. The staining methods presented offer attractive alternatives to conventional methods, especially when the algal communities being studied contain large diatom numbers. (Danovich-Wisconsin)
W80-04365

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1978--VOLUME 1. GREAT BASIN AND SNAKE RIVER BASIN ABOVE KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-155542, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ID-78-1, September 1979. 457 p, 12 Fig.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Great Basin, *Snake River basin(Idaho).

Water resources data for the 1978 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 192 gaging stations; stage only records for 2 gaging stations; stage for 6 lakes; contents for 24 lakes and reservoirs; water-quality for 103 gaging stations, 48 partial-record stations, and 179 wells; and water levels for 429 observation wells. Also included are data for 57 crest-stage partial-record stations and 191 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (Kosco-USGS)
W80-04366

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1978--VOLUME 2. UPPER COLUMBIA RIVER BASIN AND SNAKE RIVER BASIN BELOW KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-155559, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ID-78-2, September 1979. 377 p, 22 Fig.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Upper Columbia River basin(Idaho), Snake River basin(Idaho).

Water resources data for the 1978 water year for Idaho consist of records of stage, discharge, and water quality of streams, stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 192 gaging stations; stage only records for 2 gaging stations; stage for 6 lakes; contents for 24 lakes and reservoirs; water-quality for 103 gaging stations, 48 partial-record stations, and 179 wells; and water levels for 429 observation wells. Also included are data for 57 crest-stage partial-record stations and 191 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (Kosco-USGS)
W80-04367

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1974 THROUGH SEPTEMBER 1977,
Geological Survey, Lakewood, CO. Water Resources Div.
B. J. Cochran, H. E. Hodges, R. K. Livingston, and R. D. Jarrett.
Available from: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO Pc $3.25 Mf $3.50. Geological Survey open-file report 79-1261, August 1979. 673 p, 3 Fig, 4 Tab, 16 Ref.

Descriptors: *Rainfall-runoff relationships, *Basic data collections, *Hydrologic data, *Small watersheds, *Colorado, Streamflow, Gaging stations, Discharge measurement, Rain gages, Storms, Storm drains, Urban hydrology, Urban runoff, Denver(Colo).

Rainfall-runoff data from small watersheds in Colorado are being collected and analyzed for the purpose of defining the flood characteristics of these and other similar areas. Data collected from October 1974 through September 1977 at a total of 18 urban stations, 10 Denver Federal Center stations, and 48 rural (or highway) stations are tabulated at 5-minute time intervals. Additional information presented includes station descriptions and methods of data collection and analysis. (Kosco-USGS)

W80-04371

STORMWATER-RUNOFF DATA FOR A MULTIFAMILY RESIDENTIAL AREA, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Hardee, R. A. Miller, and H. C. Mattraw, Jr.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO, paper copy $9.00 microfiche $3.50. Geological Survey open-file report 79-1295, 1979. 68 p, 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Storm runoff, *Rainfall-runoff relationships, *Urban runoff, *Water quality, *Florida, Hydrologic data, Rainfall, Chemical analysis, *Dade County(Fla), Residential area.

Rainfall, stormwater discharge, and water-quality data for a multifamily residential area in Dade County, Florida, are summarized. Loads for 19 water-quality constituents were computed for runoff from 16 storms from May 1977 through June 1978. The 14.7 acre basin contains apartment buildings with adjacent parking lots. The total surface area consists of 70.7 percent impervious material. (Kosco-USGS)
W80-04375

WATER RESOURCES OF THE SANTA ROSA INDIAN RESERVATION AND VICINITY, RIVERSIDE COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04376

HYDROLOGIC CONDITIONS IN BROWARD COUNTY, FLORIDA, 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
T. R. Beaven.
Available from: OFSS U.S. Geological Survey Box 25425, Federal Center Denver, CO, paper copy $13.00 microfiche $3.50. Geological Survey open-file report 79-1258, 1979. 93 p, 47 Fig, 10 Tab, 25 Ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Water quality, *Florida, Data collections, Rainfall, Runoff, Streamflow, Water analysis, Water wells, Water utilization, Pumping, Withdrawal, Groundwater recharge, Aquifer characteristics, Hydrographs, Water pollution sources, Water management(Applied), Broward County(Fla).

During the 1976 water year, rainfall was 3.6 percent below average in Broward County, Fla. Water levels in the Pompano Beach and Dixie well fields were lower during the peak of the 1976 dry season than the peak of the record low dry season in 1971. Flow in the major canals was variable during the 1976 water year compared to 1962-75 averages. Flows in Cypress Creek, Middle River, and Snake Creek at S-29 were higher than the average. Flows in Plantation Canal and South New River were equal to the 1962-75 averages, while Hillsboro, North New River, and Snake Creek at N.W. 67th Avenue were below the long-term averages. The concentrations of principal mineral constituents in surface water in Broward County were within limits established by Florida State Water Standards, with the exception of iron at one station. Total coliforms were equal to or within permissible limits for class III water and waters for public supply in Broward canals at all sites during the 1976 water year. Fecal coliform did not exceed the permissible limit for public water supply at any of the sites during the 1976 water year. (Kosco-USGS)
W80-04378

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE NOWOOD RIVER DRAINAGE AREA, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-04382

HYDROLOGIC AND RELATED DATA FOR WATER-SUPPLY PLANNING IN AN INTENSIVE-STUDY AREA, NORTHEASTERN WICHITA COUNTY, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04385

THE CALIFORNIA WATER ATLAS.
California Office of Planning and Research, Sacramento.
For primary bibliographic entry see Field 2A.
W80-04444

A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN EASTERN NORTH-CENTRAL, AND SOUTHEASTERN UNITED STATES.
National Eutrophication Survey, Corvallis, OR.
For primary bibliographic entry see Field 5C.
W80-04458

8. ENGINEERING WORKS

8A. Structures

DESIGN CRITERIA FOR COOLING-WATER OUTLET STRUCTURES,
Karlsruhe Univ., (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W80-04310

SUBGLACIAL CONSTRUCTIONS AND INVESTIGATIONS AT BONDHUSBREEN, NORWAY,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 2C.
W80-04339

DOWN EASTERS HEAD FOR THE BEDROCK.
Ground Water Age, Vol 14, No 5, p 25, 28, January, 1980.

Descriptors: *Maine, *Bedrock, *Water wells, *Drilling, Dug wells, Well regulations, Municipal water, Aquifers, Granites.

Residential water wells in Maine, which are underlain by granite, are either shallow, dug wells in glacial drift or deep, drilled wells in bedrock well below the water table. Municipal wells require more water than most aquifers in Maine are capable of producing. Finding adequate aquifers requires exploratory drilling in valleys. Maine is one of the least regulated states in terms of water wells. (Purdin-NWWA)
W80-04434

PERCUSSION DRILLING TECHNOLOGIES,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol 34, No 1, p 29-31, January, 1980. 3 Fig.

Descriptors: *Drilling, *Technology, Drilling equipment, Cable-tool drilling, Developing countries, *Water wells.

In developing countries a hand-dug well requires more time and capital than a drilled well. However, drilled wells are impractical due to high maintenance and operating costs, difficulty in obtaining spare parts and transporting equipment. A more practical approach would be the development of labor-intensive percussion drilling technology. Tripods can be constructed of bamboo, timber, lumber, or scrap metal pipe depending on availability. Vertical reciprocating motion can be produced by means of a spring pole, a lever, or by alternately pulling and releasing a rope. In some areas, a motorized cathead can be used. The dry bucket percussion drilling method is simple and fast as long as the soil adheres to the inside of the bucket. In the bail-down method, water is added to the borehole and the casing is lowered by bailing soil from beneath the casing. Bailers can be constructed from sections of well casing and scrap metal. This method is suitable for large diameter (10-inch) wells in sandy formations. (Purdin-NWWA)
W80-04435

LARGE DIAMETER SHALLOW WELLS.
Canadian Water Well, Vol 6, No 1, p 21, February, 1980.

Descriptors: *Shallow wells, *Water wells, *Construction, Dug wells, Concrete pipes, Water pollution, Heaving, Drying, Water storage, Domestic water.

Hand-dug wells usually have little standing water due to difficulty in digging below the water table. The bucket boring machine and concrete well tiles have overcome this problem. Other problems of dug or bored wells are their susceptibility to pollution, heaving of fine sand and silt, and drying during droughts. However, when properly constructed, bored wells are extremely effective, especially in areas where the rate of aquifer yield is limited or where fine sand prohibits the use of screened wells. Bored wells provide an adequate storage volume for domestic water use where a conventional drilled well cannot. (Purdin-NWWA)
W80-04473

8B. Hydraulics

DISPERSIVITY AND VELOCITY RELATIONSHIP FROM LABORATORY AND FIELD EXPERIMENTS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg bei Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
For primary bibliographic entry see Field 2F.
W80-04235

SUBMERGED RADIAL HYDRAULIC JUMP,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
J. A. McCorquodale, and A. M. Khalifa.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15250, p 355-367, March 1980. 11 Fig, 12 Ref, 2 Append.

Descriptors: *Hydraulic jump, *Energy dissipation, *Outlet works, *Settling basins, Hydraulics, Dams, Energy, Velocity, Pressure, Sluice gates, Froude number, Laboratory tests, Hydraulic design, *Submerged flow, *Radial flow.

A slight flaring of the side walls of the stilling basin can be advantageous in reducing the exit velocities. The hydraulic jump in such a stilling basin is referred to as a radial hydraulic jump. When the sluice gates discharge directly to the stilling basin, a submerged radial hydraulic jump will probably occur. An experimental study produced surface profiles, bed pressure, and length characteristics for the submerged radial jump. A fourth-degree polynomial was used to describe the surface profile. The submerged radial jump lengths were found to be from 50% to 70% of the corresponding submerged rectangular jump lengths. Improved energy dissipation is also characteristic of the radial jumps. The model consisted of a 1.0-m long stilling basin with a total divergence angle of 13.5 degrees located downstream through a sluice gate. A theoretical equation was proposed to describe the relationship among: gate submergence, exit depth, initial depth, initial Froude number, and basin divergence. (Adams-ISWS)
W80-04311

SUMMARY OF HYDROLOGIC DATA FOR TAMPA BYPASS CANAL SYSTEM, JULY 1974 TO SEPTEMBER 1976,
Geological Survey, Tallahassee, FL. Water Re-

sources Div.
K. W. Causseaux, and H. C. Rollins.
Available from: OFSS, USGS Box 25424, Fed. Ctr. Denver, CO, paper copy $10.00 microfiche $3.50. Geological Survey open-file report 79-1297, 1979. 74 p, 10 Fig, 16 Tab, 1 Ref.

Descriptors: *Hydrologic data, *Canals, *Groundwater, *Surface waters, *Data collections, Flood control, Water wells, Networks, Monitoring, Sampling, Sites, Water quality, Trace metals, Nutrients, Chemical analysis, Pesticides, Aquifers, Potentiometric levels, Discharge(Water), Florida, *Tampa Bypass Canal(Fla).

The Tampa Bypass Canal is part of a flood-control project east of the city of Tampa, Fla., under construction by the U.S. Army Corps of Engineers. It will divert floodwater from the Hillsborough River at points upstream from Tampa through a canal system to McKay Bay. The U. S. Geological Survey began a hydrologic data program in 1974 to provide data needed to identify existing hydrologic conditions and to evaluate the effects of canal construction. A network of surface-water and ground-water sites was designed to monitor changes in nutrients, trace metals, inorganic constituents, pesticides, and benthic invertebrates along the canal system; to monitor changes in trace elements, common constituents, nitrates, specific conductance, and chlorides in the Floridan aquifer; and to monitor changes in the potentiometric surface of the Floridan aquifer. In 1974-75, the monitoring program consisted of drilling 12 monitor wells and initiation of the surface-water sampling program. In 1976, the program consisted of drilling 5 additional wells, continuation of the surface-water sampling, initiation of ground-water sampling program, and monitoring of discharge from springs. Water-quality data for 9 surface-water sites in the basin were collected at each of the control structure sites, in the tidal portion of the canal, and at each of the major tributaries to the canal system. (Kosco-USGS)
W80-04373

8C. Hydraulic Machinery

GROUND WATER HEAT PUMPS - A COST COMPARISON,
Wilson (Ian D.) Associates Ltd., Barrie (Ontario).
For primary bibliographic entry see Field 6B.
W80-04424

8D. Soil Mechanics

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For primary bibliographic entry see Field 8A.
W80-04473

10. SCIENTIFIC AND TECHNICAL INFORMATION

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Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2J.
W80-04304

SYMPOSIUM ON GLACIER BEDS: THE ICE-ROCK INTERFACE.
For primary bibliographic entry see Field 2C.
W80-04313

PROCESSES OF GLACIER EROSION ON DIFFERENT SUBSTRATA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2C.
W80-04314

LOCAL FRICTION LAWS FOR GLACIERS: A CRITICAL REVIEW AND NEW OPENINGS,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
For primary bibliographic entry see Field 2C.
W80-04318

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1 NATURE OF WATER

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4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 14
JULY 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
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The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

ROLE OF BOREHOLE GEOPHYSICS IN DEFINING THE PHYSICAL CHARACTERISTICS OF THE RAFT RIVER GEOTHERMAL RESERVOIR, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
W. S. Keys, and J. K. Sullivan.
Geophysics, Vol 44, No 6, p 1116-1141, June 1979. 26 Fig, 4 Tab, 11 Ref.

Descriptors: *Borehole geophysics, *Geothermal studies, *Groundwater, *Thermal water, *Idaho, Physical properties, Reservoirs, Logging(Recording), Deep wells, Computer models, Instrumentation, Borehole cameras, Radioisotopes, Raft River(Idaho).

Numerous geophysical logs have been made in three deep wells and in several intermediate depth core holes in the Raft River geothermal reservoir, Idaho. Laboratory analyses of cores from the intermediate depth holes were used to provide a qualitative and quantitative basis for a detailed interpretation of logs from the shallow part of the reservoir. A less detailed interpretation of logs from the deeper part of the reservoir is based on much less corroborative evidence. Extensive use was made of computer plotting techniques to arrive at some interpretations. Both the stratigraphic correlation utilizing a full suite of lots and the attitude of bedding calculated from acoustic televiewer logs indicate gentle dips throughout most of the reservoir with some local flexures. Televiewer logs permitted the location and orientation of numerous fractures and several features that may be faults. Temperature and flowmeter logs provide evidence that these fractures and faults are conduits that conduct hot water to the wells. One of the intermediate depth core holes penetrated a hydrothermally altered zone that includes several fractures producing hot water. This altered production zone could be distinguished by several logs. Borehole gamma spectrometry can be used to identify anomalous concentration of uranium, thorium, and potassium which are probably due to transportation by hydrothermal solutions. Computer crossplotting was used as an aid to the identification of such rock types as quartzite, quartz monzonite, and biotite schist in the deeper wells. Alteration of biotite schist to chlorite schist was also recognizable on these logs using computer-based analysis. Borehole geophysics not only provided much information on the Raft River geothermal reservoir but also permitted the lateral and vertical extrapolation of core and test data and bridged the gap between surface geophysical data and core analysis. (Kosco-USGS)
W80-04559

PERMITTIVITY OF ICE AND WATER AT MILLIMETER WAVELENGTHS,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 2C.
W80-04635

1B. Aqueous Solutions and Suspensions

PHYSICAL PROPERTIES OF CONFINED DREDGED MATERIALS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, K. W. Launius, and L. E. Deuel, Jr.
Soil Science, Vol 129, No 2, p 95-106, February 1980. 8 Fig, 2 Tab, 9 Ref. DACW39-75-C-0120.

Descriptors: *Dredging, *Physical properties, *Mineralogy, Slurries, Permeability, Shrinkage, Bulk density, Moisture content, Field capacity, Subsurface drainage, Plasticity index, *Dredged materials, *Confinement areas, Field-moisture data, Unsaturated permeabilities, Fine-grained-dredged materials, Volume changes, Moisture retention, Air drying.

Physical properties of fine-grained dredged materials from four diverse locations were determined. The results were useful to those involved in designing, managing, and reclaiming dredged-material-confinement areas. Many of the characteristics of the material were shown to undergo irreversible changes once the materials were dried. Initially, the material behaved like a slurry, but even after one drying, the properties changed so that the materials did not reswell to their original volume, the bulk density at a given moisture content was less, and the plasticity index was less. Physical properties of the materials were most closely correlated with mineralogy and the plasticity index. Those materials with smectitic minerals and greater plasticity indices retained greater amounts of water and had lower permeabilities than materials with other clays or lower plasticity indices. (Roberts-ISWS)
W80-04539

2. WATER CYCLE

2A. General

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4A.
W80-04512

HYDROLOGY OF THE NAHANNI KARST, NORTHERN CANADA, AND THE IMPORTANCE OF EXTREME SUMMER STORMS,
Georgia Univ., Athens. Dept. of Geography.
G. A. Brook, and D. C. Ford.
Journal of Hydrology, Vol 46, No 1/2, p 103-121, March 1980. 9 Fig, 3 Tab, 8 Ref.

Descriptors: *Karst, *Canada, *Perched water, *Lakes, *Sinks, Groundwater movement, Subsurface drainage, Rhodamine, Tracers, Dyes, Springs, Rainfall, Hydrogeology, Caves, Geologic control, Hydrology, Surface-groundwater relationships, *Poljes, Flow conduits, Estavelles, Cols, Dolines, Ponors.

Discovered in August 1971, the Nahanni karst is the most complex high-latitude karst known. Mean annual temperature is -4.5C and precipitation 566 mm. The most spectacular landforms occur on a structural col (the 'north karst') connecting south Nahanni and Ram Plateau. Between July 19 and 31, 1972, an extreme summer storm deposited 224 mm of rain on the area. First, Second, and Third Poljes in the north karst flooded; maximum water depths were 8.5, 25, and 8 m, respectively, and Third Polje overflowed. The level of Raven Lake (0.25-0.5 km long) rose 49 m at an average 2.9 m per day. Flooding occurs through random perching of water above and below ground where conduits have been heavily alluviated. There is no highly integrated regional groundwater body; water moves along independent or poorly integrated conduits or multiple aquifers. Some depressions are inundated by groundwater entering through estavelles, others when surface and spring inputs exceed drainage. Although winter snowfall averages 213 cm, in most years spring snowmelt does not appear to cause prolonged flooding. However, it raises water levels in the aquifer leaving the area prone to flooding by frequent, intense summer rains. The magnitude and complexity of hydrologic activity in the subarctic Nahanni karst is remarkable, being comparable with that in tropical and temperate carbonate areas. (Visocky-ISWS)
W80-04513

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
A. J. Pearce, J. H. C. Gash, and J. B. Stewart.
Journal of Hydrology, Vol 46, No 1/2, p 147-163, March 1980. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Rainfall, *Interception, *Forests, *Model studies, Mathematical models, Meteorological data, Evaporation, Vegetation, Vegetation effects, Trees, Pine trees, Canopy, Precipitation(Atmospheric), Water loss, Meteorology.

Meteorological data collected over grassland were used in the Rutter and analytical interception models to predict interception losses for a Scots pine stand in Thetford Forest during 84 weeks in 1975 and 1976. Rutter and analytical model estimates using grassland data overestimated the observed losses by 37% and 25%, respectively; estimates using data collected over the forest overestimated by 8% and 5%, respectively. Systematic differences in the meteorological parameters controlling the evaporation rate from wet forest and wet grass are the cause of the overestimation of interception losses when grassland data are used in the models. Mean air temperature over the wet forest was 0.75C cooler, mean wet-bulb depression was 0.25C smaller, and mean vapor pressure deficit was 0.4 mbar smaller than the mean values observed over wet grass in 116 hr when more than 0.5 mm of rain fell at both observation sites. No significant differences between sites were found when both the grass and the forest canopy were dry. Regression equations for forest-site parameters on grassed-site parameters were used to adjust the grassed-site data for use in the models. Analytical model estimates using adjusted data were closely comparable to both observed losses and model estimates using above-forest data. Rutter model estimates using adjusted data were significantly different from the observed losses for 1976 and for the combined 1975-1976 data, but were comparable with the observed losses and model estimates using above-forest data in 1975. (Sims-ISWS)
W80-04514

USDAHL-74 MODEL AS A PLANNING TOOL,
Geological Survey, Towson, MD.
G. T. Fisher, J. E. Ayars, H. N. Holtan, and D. L. Nelson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1347-1352, November-December 1979. 7 Fig, 4 Tab, 7 Ref.

Descriptors: *Land use, *Planning, *Watersheds(Basins), *Runoff, *Maryland, *Model studies, Mathematical models, Urban runoff, Agricultural runoff, Pastures, Crops, Forest watersheds, Drainage, Mountains, Rainfall, Streamflow, Evaporation, Water resources.

The University of Maryland version of the USDAHL-74 model was used to simulate the hydrology of Maryland watersheds located in three different geologic provinces. The results of the simulation demonstrated the applicability of the model for use in evaluating the effects of changes in land use on diversified watersheds. (Sims-ISWS)
W80-04529

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
R. Koch, R. Curry, and M. Weber.
Yellowstone Impact Study, Technical Report No 2, 1977. 173 p, 38 Fig, 23 Tab, 73 Ref, 3 Append.

Descriptors: *Hydrology, *Channel morphology, *Montana, *River basins, *Watersheds(Basins), Rivers, Alluvial channels, Data collections, Streamflow, Flood frequency, Floods, Gaging stations, Sediment discharge, Diversion, Streambeds, Sediments, Discharge(Water), Distribution patterns, Regimen, Networks, Precipitation(Atmospheric), Shape, Meanders, Braiding, *Yellowstone River Basin(MT), Hydraulic geometry.

The impact of water development, in particular of a decrease in discharge, on the morphology and sediment transport of the Yellowstone River was the subject of this report. In the past, water use has increased slowly along the Yellowstone, the major

1

demand being for irrigation. The impact on the bankfull discharge as a result of this type of development has been small. The sediment characteristics in the basin have been recently altered through the construction of Yellowtail Dam, which has decreased the sediment load of the Bighorn River as much as 80%. The levels of depletions considered in this report were small for the bankfull discharge; the relative impact was less for larger flows and greater for lesser flows. The changes in stage resulting from these changes in discharge would also be small, as would changes in width, depth, and velocity. The impact of changes in flow regime on sediment transport would be marked when the effect of this modification on total volume is considered. Perennial streams, particularly those that head in major mountain ranges in Wyoming and Montana, are amenable to predictable hydraulic geometry relationships. However, the small perennial and ephemeral streams in southeastern Montana do not bear the usual relationship between bankfull stage and recurrence interval. Instead of being characterized by a bankfull flow event on the average of once every 1.5 years like the regional perennial streams, the local ephemeral streams achieve that discharge only once every 15 to 25 years, or even less frequently. Additionally, the streams are highly irregular from site to site so that, for example, the ratio between the 25-year peak discharge and the 1.5-year peak discharge on streams of a fixed drainage size varies by a factor of as much as two orders of magnitude between sites separated by but tens of miles. (Humphreys-ISWS)
W80-04542

A PRACTICAL MODEL FOR LINEAR AND NONLINEAR RUNOFF,
Nebraska Univ. at Omaha. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04614

REGIONAL DROUGHT AND FLOOD FREQUENCY ANALYSIS: THEORETICAL CONSIDERATION,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
For primary bibliographic entry see Field 6A.
W80-04618

2B. Precipitation

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 2A.
W80-04514

INSTANTANEOUS RAINFALL RATE: ITS MEASUREMENT AND ITS INFLUENCE ON HIGH-VOLTAGE TRANSMISSION LINES,
American Electric Power, North Liberty, IN.
For primary bibliographic entry see Field 7B.
W80-04538

A GENERALIZED PROBABILITY DENSITY FUNCTION FOR DOUBLE-BOUNDED RANDOM PROCESSES,
Institute of Hydraulics and Hydrology, Poondi (India).
P. Kumaraswamy.
Journal of Hydrology, Vol 46, No 1/2, p 79-88, March 1980. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Probability, *Stochastic processes, *Mathematical models, Rainfall, Runoff, Streamflow, Equations, Model studies, Statistics, Hydrology, Fitting functions, Probability density functions.

The author in 1976 developed the sinepower probability density function (SP-PDF) to fit up random processes which are bounded at the lower and upper ends, and which has a mode occurring between these two bounds. This latter condition is now relaxed, and a generalized PDF entitled double bounded probability density function (DB-PDF) was developed here. Methods for the application to practical problems of parameter estimation and to computer simulation of random variables were explained by a numerical example. (Sims-ISWS)
W80-04615

EFFECT OF SIMULATED ACID RAIN ON SULFATE MOVEMENT IN ACID FOREST SOILS,
Norwegian Forest Research Inst.
B. R. Singh, G. Abrahamsen, and A. Stuanes.
Soil Science Society of America Journal, Vol 44, No 1, p 75-80, January-February 1980. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Acidic water, *Soils, *Forest soils, Laboratory tests, Lysimeters, Acids, Acidity, Hydrogen ion concentration, Sulfates, Cations, Leaching, Chemicals, Vegetation effects, Soil science, Acid precipitation.

The effect of simulated acid rain on sulfate mobility in iron-podzol and semipodzol (Typic Udipsamments) forest soils of southern Norway was studied. The study was carried out with lysimeters with undisturbed soil. The lysimeters were watered with 'rain' having pH 5.6 and 4.3. It was found that sulfate mobility was higher in the semipodzol than in the iron-podzol, and it was dependent on their sulfate adsorption capacities which in their turn were dependent on A1 contents of these soils. Sulfate losses from applied 35S increased with increasing volume and decreasing pH of the 'rain'. The element losses were also higher in the semipodzol reflecting further higher mobility of sulfate in this soil. The total sums of cations, on equivalent basis, in the leachate from the semipodzol were nearly equal at pH 5.6 and 4.3 (0.480 and 0.485 meq/liter, respectively). In the iron-podzol, however, total sums of cations at pH 5.6 and 4.3 differed slightly (0.314 and 0.387 meq/liter, respectively). (Sims-ISWS)
W80-04640

2C. Snow, Ice, and Frost

GLACIER SURVEYS IN ALBERTA - 1977,
Inland Waters Directorate, Ottawa (Ontario).
I. A. Reid, and J. O. G. Charbonneau.
Report Series No 65, 1979, 17 p, 8 Fig, 19 Tab, 9 Ref, 2 Map.

Descriptors: *Athabasca Glacier, *Glaciers, *Hydrology, *Photogrammetry, *Mapping, *Aerial change, *Directional change, *Data collections, Saskatchewan, Canada.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is diminishing. (WATDOC)
W80-04570

THE ACTIVE AND PASSIVE MICROWAVE RESPONSE TO SNOW PARAMETERS, 1. WETNESS,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
W. H. Stiles, and F. T. Ulaby.
Journal of Geophysical Research, Vol 85, No C2, p 1037-1044, February 20, 1980. 12 Fig, 3 Tab, 7 Ref. NASA/GSFC NAS 5-23777.

Descriptors: *Snow, *Moisture content, *Remote sensing, Radar, Microwaves, Variability, Diurnal, Equipment, Electronic equipment, Instrumentation, Snowpacks, Snow surveys, Water resources, Electrical engineering.

Diurnal observations of the variation of the radar backscattering coefficient, sigma o, and microwave apparent radiometric temperature, T sub ap, with snow wetness, m sub v, were presented. The results showed that sigma o decreases and T sub ap increases with m sub v, and that the magnitude of the sensitivity to m sub v increases with microwave frequency for both active and passive microwave parameters. Moreover, while the sensitivity of sigma o to snow wetness variations increases with angle of incidence, the sensitivity of T sub ap to snow wetness is approximately angle of incidence independent. (See also W80-04625) (Sims-ISWS)
W80-04624

THE ACTIVE AND PASSIVE MICROWAVE RESPONSE TO SNOW PARAMETERS, 2. WATER EQUIVALENT OF DRY SNOW,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
F. T. Ulaby, and W. H. Stiles.
Journal of Geophysical Research, Vol 85, No C2, p 1045-1049, February 20, 1980. 5 Fig, 2 Tab, 8 Ref. NASA/GSFC NAS 5-23777.

Descriptors: *Snow, *Moisture content, *Remote sensing, Radar, Microwaves, Mathematical models, Equipment, Electronic equipment, Instrumentation, Snowpacks, Snow surveys, Water resources, Electrical engineering.

Experimental measurements of the variation of the radar backscattering coefficient, sigma o, and microwave emissivity, epsilon, with water equivalent, W, of dry snow were presented and compared to predictions of simple semiempirical scattering and emission models. The results showed that sigma o and epsilon are generally dependent on the snowpack water equivalent as well as contributions by the underlying soil, and that the variation with W is a function of frequency and angle of incidence. (See also W80-04624) (Sims-ISWS)
W80-04625

LONG-PERIOD GRAVITY WAVES IN ICE-COVERED SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
H. F. Bates, and L. H. Shapiro.
Journal of Geophysical Research, Vol 85, No C2, p 1095-1100, February 20, 1980. 1 Tab, 18 Ref, 1 Append. NOAA 03-5-022-55, NSF DPP78-01806.

Descriptors: *Gravity waves, *Ice cover, *Sea ice, *Model studies, Mathematical models, Cold regions, Oceans, Waves(Water), Theoretical analysis, Analytical techniques, Oceanography.

A floating ice sheet under compressive stress was modeled as a laterally compressed thin linearly elastic plate, floating on a compressible liquid of constant depth over a rigid bottom. This system was analyzed as a wave guide for plane waves. Sinusoidal traveling waves having vertical planes of constant phase were sought for the impulse response of the system. Two bands of gravity waves were found: (1) flexural and (2) floating-membrane. The two bands join at the critical frequency of the system, at which the impulse response is unbounded. The long-period floating-membrane gravity waves exist at all frequencies below the flexural gravity wave band. For long-period gravity waves the coupling force between plate and liquid was found to be a Hooke's Law force; the effective foundation modulus was directly proportional to the difference between the square of the phase velocity of a wave in the floating-plate system and that of a free-surface gravity wave at the same wavelength. The analogy of an elastic plate supported on an elastic foundation is apt for these long-period waves. It was concluded that the impulsive release of stored elastic energy when the compressed ice breaks supplies adequate energy to produce measurable long-period waves in floating ice. The results suggest

that long-period wave motion accompanies lateral compression of the ice sheet; hence wave measurements may provide a means of detecting the buildup of widespread compressive stress in the ice. (Sims-ISWS)
W80-04634

PERMITTIVITY OF ICE AND WATER AT MILLIMETER WAVELENGTHS,
Georgia Inst. of Tech., Atlanta.
M. D. Blue.
Journal of Geophysical Research, Vol 85, No C2, p 1101-1106, February 20, 1980. 4 Fig, 2 Tab, 7 Ref, 1 Append. NASA NSG-5082.

Descriptors: *Ice, *Water, *Electrical properties, *Microwaves, Refractivity, Reflectance, Measurement, Laboratory tests, Analytical techniques, Temperature, Model studies, Mathematical models, Permittivity, Dielectric properties.

Measurements of reflectivity of water and ice at 100 GHz, 140 GHz, and 180 GHz were reported. Measurements on water covered the temperature range 0C to 50C. No anomalies in the dielectric properties of water due to the presence of either salts or organic matter were found. The reflectivity of water and its temperature dependence were consistent with recent dielectric property models derived from data at other wavelengths. The index of refraction of fresh ice was constant at 1.78 throughout this region. (Sims-ISWS)
W80-04635

CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA,
Cold Regions Research and Engineering Lab., Hanover, NH.
W. F. Weeks, and A. J. Gow.
Journal of Geophysical Research, Vol 85, No C2, p 1137-1146, February 20, 1980. 10 Fig, 1 Tab, 8 Ref, 1 Append.

Descriptors: *Ice, *Sea ice, *Ice cover, *Crystals, *Alaska, *Arctic Ocean, On-site investigations, On-site collections, Sampling, Currents(Water), Ocean currents, Continental shelf, Cold regions, Crystal alignments, Fast ice.

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between the Bering Strait and Barter Island have shown that the great majority of the ice samples (95%) exhibit striking c axis alignments within the horizontal plane. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane were commonly less than + or - 10 deg for samples collected near the bottom of the ice. At a given site the mean c axis direction may vary as much as 20 deg with vertical location in the ice sheet. The c axis alignments in the nearshore region generally paralleled the coast, with strong alignments occurring in the lagoon systems between the barrier islands and the coast and seaward of the barrier islands. In passes between islands and in entrances such as the opening to Kotzebue Sound the alignment was parallel to the channel. Only limited observations were available farther seaward over the inner (10- to 50-m isobaths) and outer (50-m isobath to shelf break) shelf regions. These indicated NE-SW and E-W alignments, respectively, in the Beaufort Sea north of Prudhoe Bay. (Sims-ISWS)
W80-04636

2D. Evaporation and Transpiration

RAINFALL INTERCEPTION IN A FOREST STAND ESTIMATED FROM GRASSLAND METEOROLOGICAL DATA,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 2A.
W80-04514

CONSTRUCTION AND PERFORMANCE OF LARGE AUTOMATIC (NONWEIGHING) LYSIMETERS,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
G. A. Reichman, E. J. Doering, L. C. Benz, and R. F. Follett.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1343-1346, 1352, November-December 1979. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Lysimeters, *Evapotranspiration, *On-site investigations, *Irrigation effects, *Crop response, Infiltrometers, Soil water movement, Evaporation, Transpiration, Drainage systems, Measurement, Great Plains, Corn(Field).

The construction of 12 large, nonweighing lysimeters with automatic water table controls was described. Three distinct layers of the Hecla loamy fine sand profile were used to reconstruct the natural soil profile in the lysimeters. The controls are automatically operated with time clocks and float switches to maintain selected water table levels. The system is capable of replacing evapotranspiration losses of up to 2 cm every 24 h and of removing excess profile water of up to 4 cm per 24-h period. The performance of the system with respect to changes in water table elevation due to different precipitation and air temperatures was shown. The system has functioned satisfactorily for 4 yr with minimum attention and maintenance. (Adams-ISWS)
W80-04528

SIMULATION OF THE EFFECTS OF TRANSPIRATION LOSSES FROM THE UNSATURATED ZONE ON SEEPAGE FROM A SOIL SLOPE,
Jonkershoek Forestry Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 2G.
W80-04620

2E. Streamflow and Runoff

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, I. GENERAL METHODOLOGY OF THE APPROACH,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 1/2, p 5-34, March 1980. 9 Fig, 1 Tab, 45 Ref.

Descriptors: *Streamflow, *Discharge(Water), *Model studies, Mathematical models, Data processing, Statistics, Synthesis, Synthetic hydrology, Stochastic processes, Time series analysis, Rivers, Streams, Hydrology, Pattern recognition.

In stochastic models for streamflow synthesis no consideration is given to the presence of groups of data corresponding to wet and dry periods. The existence of such groups in geophysical records including hydrologic records was well emphasized by Hurst. This paper is the first in a series of three, which develops a feature synthesis model for hydrologic records utilizing properties assignable to groups and the concepts of pattern recognition. Part II will discuss the application of the model to natural streamflow records, and Part III will demonstrate the efficacy of the proposed model through testing the synthesized streamflows from the viewpoints of various statistical and hydrological tests. (Sims-ISWS)
W80-04510

WELSH FLOODPLAIN STUDIES, II. APPLICATION OF A QUALITATIVE INUNDATION MODEL,
University Coll. of Wales, Aberystwyth.
J. Lewin, and D. Hughes.
Journal of Hydrology, Vol 46, No 1/2, p 35-49, March 1980. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Floods, *Flood plains, *Rivers, *Model studies, Mathematical models, Flow, Streamflow, Water levels, Watersheds(Basins), Drainage, Topography, Hydrology, *Wales, *Dyfi River(Wales), *Teifi River(Wales).

The relationship of inundating waters to patterns of floodplain relief was assessed in terms of an inundation model involving types of input, output, and transfer processes. This model was applied to floods observed in the rivers Dyfi and Teifi in mid-Wales from 1973-1977. These showed complex patterns of actual inundation sequences, involving hysteretic effects in the relationship between river stage and flood extent, and varying effects arising from human floodplain modifications, different rates of stage fluctuation, and the local incidence of floodplain forms. Further sequential studies of inundation for contrasted floodplain types should allow better understanding of floodplain conductivity as an aid to flood-routing procedures and as a help in understanding discharge-inundation relationships. (Sims-ISWS)
W80-04511

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04516

USDAHL-74 MODEL AS A PLANNING TOOL,
Geological Survey, Towson, MD.
For primary bibliographic entry see Field 2A.
W80-04529

COMPUTATION OF BED LOAD USING BATHYMETRIC DATA,
National Water Research Inst., Burlington (Ontario), Hydraulic Research Div.
For primary bibliographic entry see Field 2J.
W80-04534

DEBRIS FLOW ON PRISMATIC OPEN CHANNEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
T. Takahashi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15245, p 381-396, March 1980. 9 Fig, 19 Ref, 2 Append.

Descriptors: *Open channel flow, *Debris avalanches, *Sediment transport, Boulders, Clays, Flocculation, Mudflows, Profiles, Sediments, Velocity, Viscosity, Hydraulics, Slurries, Resistance, *Debris removal, Granular media, Segregation, Prismatic channel.

Reviews on the yield strength and viscosity of the interstitial clay slurry in debris flow prove that ordinary debris flow may be modeled as a dilatant fluid in which the intergranular forces dominate. Theoretical velocity distributions in dilatant fluid compare well with the experimental results when the value of a numerical constant is appropriately selected. The longitudinal profile of the lobate snout is satisfactorily analyzed by applying the theory of one-dimensional translation wave on an open channel, where the resistance coefficient is a function of concentration, depth, and grain diameter. A remarkable segregation of particles, in which the larger ones move upwards, occurs in debris flow due to the effects of collisions of particles. The accumulation of boulders in the front part of debris flow is a result of the faster transportation of the larger particles in the upper layer of the flow than that of the smaller ones in the lower layer. (Lee-ISWS)
W80-04535

THE DESIGN OF A FLOOD FORECASTING PROCEDURE FOR THE KLANG RIVER AT KUALA LUMPUR,
Lincoln Coll. (New Zealand).
V. J. Bidwell.

Journal of Hydrology (New Zealand), Vol 18, No 1, p 29-35, 1979. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Flood forecasting, *Water levels, *Mathematical models, *Asia, Model studies, Rivers, Streamflow, Floods, Flood flow, Watersheds(Basins), Precipitation(Atmospheric), Rainfall, Precipitation excess, Hydrology, *Malaysia, *Klang River(Malaysia).

A procedure was required for forecasting the flood level of the Klang River at the city of Kuala Lumpur, Malaysia. Using data from rainfall stations and tributary river stages, one may predict flood stage by means of a multiple-input, autoregressive, moving-average linear model. This model was calibrated from storm records by means of stepwise multiple regression. The resulting set of equations was developed into a procedure for manual computation. (Sims-ISWS)
W80-04536

A SIMPLE DIGITAL RATE-METER FOR CURRENT METERS (NOTE),
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 7B.
W80-04537

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
For primary bibliographic entry see Field 2A.
W80-04542

FLOODS IN GEORGIA, MAGNITUDE AND FREQUENCY,
Geological Survey, Doraville, VA. Water Resources Div.
M. Price.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-146244, Price code: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-137, October 1979. 269 p, 29 Fig, 6 Tab, 24 Ref.

Descriptors: *Floods, *Peak discharge, *Flood frequency, *Georgia, *Flood forecasting, Analytical techniques, Estimating, Flood recurrence interval, Gaging stations, Flood data, Rainfall-runoff relationships, Natural streams, Drainage area, River basins, Regression analysis, Model studies.

Regional relations are defined for estimating the magnitude and frequency of floods having recurrence intervals of 2, 5, 10, 25, 50, and 100 years on streams with natural flow in Georgia. Multiple-regression analyses were used to define the relationship between the flood-discharge frequency of annual peak discharges for streams draining 0.1 to 1,000 square miles and 10 climatological and physical basin characteristics. The analyses indicate that the drainage area of the basin is the most significant characteristic. Five regions having distinct flood-discharge frequency characteristics are delineated. Individual relations of flood magnitude and frequency to drainage area are given for parts of the main stems of the major rivers without significant regulation draining more than 1,000 square miles. (Kosco-USGS)
W80-04546

STATISTICAL SUMMARY OF STREAMFLOW DATA FOR KANSAS STREAMS IN THE MISSOURI RIVER BASIN,
Geological Survey, Lawrence, KS. Water Resources Div.
P. R. Jordan.
Kansas Water Resources Board, Streamflow Characteristics Technical Report No 14B, September 1979. 334 p, 14 Fig, 1 Tab, 2 Ref.

Descriptors: *Streamflow, *Flow duration, *Low flow, *High flow, *Kansas, Streams, Flow rates, Average flow, Gaging stations, Drainage area, Natural flow, Regulated flow, Basic data collections, *Missouri River basin(Kans).

Tables summarizing streamflow data are presented for each gaging station in the Missouri River basin in Kansas that had at least 1 year of record through 1976. These tables summarize daily streamflow as follows: (1) the number of days in each year that the daily discharge was between selected limits (duration tables), (2) the lowest mean discharge for selected numbers of consecutive days in each year, (3) the highest mean discharge for selected numbers of consecutive days in each year, and (4) for stations having at least 20 years of record, the percentage of days in each month when the discharge equaled or exceeded selected class limits (monthly duration tables). These summaries provide useful information for appraising and comparing the hydrologic characteristics of drainage basins, for classifications of streams for regulatory purposes, and for design of water-supply reservoirs and flood-control works. (Kosco-USGS)
W80-04550

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-04551

HYDROLOGIC AND HUMAN ASPECTS OF THE 1976-77 DROUGHT,
Geological Survey, Menlo Park, CA. Water Resources Div.
H. F. Matthai.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.25. Geological Survey Professional Paper 1130, 1979. 84 p, 30 Fig, 52 Ref.

Descriptors: *Hydrologic budget, *Droughts, *United States, *Groundwater, *Low flow, Withdrawal, Reservoir storage, Water shortage, Precipitation(Atmospheric), Water conservation, Water quality, Surface waters, Rationing(Water), Rural areas, Legal aspects, Land subsidence, Water management(Applied).

The drought of 1976-77 was the most severe in at least 50 years in many parts of the United States. Record low amounts of rainfall, snowfall, and runoff, and increased withdrawals of ground water were prevalent. The use of carry-over storage in reservoirs during 1976 maintained streamflow at near normal levels, but some reservoirs went dry or dropped below the outlet works in 1977. Carry-over storage in the fall of 1977 was very low. Ground-water levels were at or near record low levels in many aquifers, hundreds of wells went dry, and thousands of wells were drilled. Yet no wide-spread deterioration of ground-water quality was reported. Water-quality problems arose in some streams and lakes, but most were localized and of short duration. Water rationing became a way of life in numerous areas, and water was hauled in many rural areas and to a few towns. Water use was affected by legal agreements or decisions, some of which were modified for the duration of the drought, and by the inability of water managers to efficiently manage surface and ground waters as one resource under existing law. There are still many drought related problems to solve and many challenges to be met before the next drought occurs. The advancement of techniques in many fields of endeavor in recent years plus ongoing, planned, and proposed research on drought and the risks involved are promising thrusts that should make it easier to cope with the next drought. (Kosco-USGS)
W80-04552

MAINE COASTAL STORM AND FLOOD OF FEBRUARY 2, 1976,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Morrill, E. H. Chin, and W. S. Richardson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00. Geological Survey Professional Paper 1087, 1979. 20 p, 10 Fig, 2 Plates, 5 Tab, 7 Ref.

Descriptors: *Maine, *Coasts, Storm surge, *Floods, *Tidal waters, High water mark, *Wind tides, Estuaries, Flood damage, New England, Documentation, Meteorological data, Hydrologic data, Drainage area, Streamflow, Sites, Maps, Currents(Water), Gaging stations, *Bangor area(Maine).

A business section of Bangor, Maine, was flooded with 12 feet (3.7 m) of water on February 2, 1976. The water surface elevation reached 17.46 feet (5.32 m) above national geodetic vertical datum of 1929 (NGVD), approximately 10.5 feet (3.2 m) above the predicted astronomical tide at Bangor. The unusually high water resulted from a tidal storm surge caused by prolonged strong, south-southeasterly winds which occurred near the time of astronomical high tide. Winds exceeded 64 knots off the New England coast. The resulting flood was the third highest since 1846 and is the first documented tidal flood at Bangor. This report documents the meteorological and hydrologic conditions associated with the flooding and also contains a brief description of storm damage from Eastport to Brunswick, Maine. Included are flood elevations in the city of Bangor and along the coast of Maine east of the Kennebec River. (Kosco-USGS)
W80-04553

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON RURAL UNREGULATED STREAMS IN NEW YORK STATE, EXCLUDING LONG ISLAND,
Geological Survey, Albany, NY. Water Resources Div.
T. J. Zembrzuski, Jr., and B. Dunn.
Geological Survey Water-Resources Investigations 79-83 (open-file report), 1979. 66 p, 5 Fig, 7 Tab, 24 Ref, 3 Append.

Descriptors: *Flood forecasting, *Peak discharge, *Floods, *Flood frequency, *New York, Streams, Analytical techniques, Flood recurrence interval, Regional analysis, Gaging stations, Regression analysis, Equations, Estimating, Drainage area, Precipitation(Atmospheric), *Log-Pearson type III statistics.

Techniques are presented for estimating the magnitude and frequency of floods at ungaged sites on unregulated rural streams in New York, excluding Long Island. The discharge-frequency data and basin characteristics of 220 stream-gaging stations in New York and adjacent States were used in developing multiple linear regression equations for floods ranging in recurrence interval from 2 to 100 years. Separate equations were developed for northern, southeastern, and western New York. Standard errors of estimate of the 100-year flood range from 32.9 percent in the southeastern region to 42.8 percent in the western region. Drainage area is the independent variable needed in all equations; other variables needed, depending on region, are main-channel slope, storage index, and mean annual precipitation. A method is given for obtaining improved discharge-frequency relationships at gaged sites by weighting log-Pearson type III and regression estimates according to their variances. Basin characteristics, log-Pearson type III statistics, and regression and weighted estimates of the frequency-discharge relationship, are tabulated for the gaging stations used in the regression analyses. (Kosco-USGS)
W80-04556

FLOOD HAZARD STUDY TALLASSEEHATCHEE CREEK AND TRIBUTARIES IN VICINITY OF JACKSONVILLE, ALABAMA.
Soil Conservation Service, Auburn, AL.
Report No ALA-OSPFP 100902, March 1980. p 64, 21 Fig, 6 Tab, 9 Ref, 3 Append. HUD P-1009.

Descriptors: *Alabama, *Flood profiles, *Flood data, *Flood plain zoning, Land use, Floodways, Flood data, Flood frequency, Topography, Water levels, Overflow, Streamflow, Floods, Flood damage.

Local flood problems and hazards are identified for the city of Jacksonville, Alabama, to serve as guidelines for local governments in the reduction of potential flood losses caused by unwise development in flood-prone areas. The area involved in the study includes 8 stream miles and drainage areas ranging from 0.7 to 9.5 sq mi for Tallasseehatchee Creek, 9.8 to 17.8 sq mi for Little Tallasseehatchee Creek, and 0.8 to 4.2 sq mi for the tributaries. The area has a humid and temperate climate with a yearly rainfall average of 53.24 in, generally well distributed throughout the year. Land use in the area includes cropland, pasture, woodland, residential, commercial, industrial, and roads. Rapid urbanization is producing increasing pressure for flood plain development. Reliable information on the flood history of the area is not available. Included in the report are Flood Hazard Area Photomaps, Flood Profiles, Discharge-Elevation-Frequency Data, and Floodway Data for streams. Regulatory and corrective measures to minimize the risk of flooding are discussed along with pertinent existing State and local flood-prone area regulations. With present conditions a 100-year flood would damage approximately 484 acres while a 500-year flood would damage approximately 560 acres. Projected urban growth along the streams studied is expected to cause significant change in flood levels along the main streams. (Seigler-IPA)
W80-04611

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, II. APPLICATION OF NATURAL WATERSHEDS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 3/4, p 197-217, April 1980. 7 Fig, 5 Tab, 9 Ref, 2 Append.

Descriptors: *Streamflow, *Synthetic hydrology, *Model studies, Mathematical models, Watersheds(Basins), River flow, Rivers, Flow, Drainage, Stochastic processes, Analytical techniques, Equations, Hydrology, Pattern recognition.

The feature synthesis model was utilized to synthesize streamflow realizations from three natural rivers. The practical usefulness of the various techniques employed in consonance with the application of the model was explained with illustrative examples dealing with streamflow records. The salient peculiarities associated with the construction and operation of the model for streamflow synthesis were presented. (See W80-04510 and W80-04613) (Sims-ISWS)
W80-04612

STOCHASTIC SYNTHESIS OF HYDROLOGIC DATA BASED ON CONCEPTS OF PATTERN RECOGNITION, III. PERFORMANCE EVALUATION OF THE METHODOLOGY,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Journal of Hydrology, Vol 46, No 3/4, p 219-237, April 1980. 4 Fig, 7 Tab, 6 Ref.

Descriptors: *Streamflow, *Synthetic hydrology, *Statistics, *Model studies, Mathematical models, Evaluation, Water levels, Flow, River flow, Analytical techniques, Methodology, Hydrology, Statistical methods, Pattern recognition.

Synthetic realizations of monthly streamflows obtained by utilizing a feature synthesis model were tested from statistical and hydrological viewpoints. In terms of statistical considerations the synthetic realizations were shown to possess relevant properties of the historical streamflows at the series level as well as at the monthly level. From hydrological considerations, the synthetic realizations were found to be embedded in properties that are associated with clusters of low flows and clusters of peak flows that are comparable to those in the historical sample. The model results suggested that the synthesis of streamflows based on concepts of pattern recognition is a potentially viable approach and warrants further investigation. (See also W80-04612) (Sims-ISWS)
W80-04613

A PRACTICAL MODEL FOR LINEAR AND NONLINEAR RUNOFF,
Nebraska Univ. at Omaha. Dept. of Civil Engineering.
W. F. Rogers.
Journal of Hydrology, Vol 46, No 1/2, p 51-78, March 1980. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Runoff, *Peak discharge, *Model studies, Mathematical models, Discharge(Water), Drainage, Base flow, Rainfall, Watersheds(Basins), Storms, Storm runoff, Hydrographs, Hydrology.

Second-order standardized peak discharge distribution was defined as the log of peak discharge divided by runoff volume in inches squared regressed on log runoff volume in inches. The slope of this distribution is -1.0 for linear basins and less than -1.0 for nonlinear drainage basins. High r sq-values indicate runoff volume alone accounts for an average of 86% of the variation in the dependent variable. Because most drainage basins exhibit nonlinear second-order peak dischage distribution, this model is useful in predicting peak discharges for rainfall and runoff events of any duration, spatial distribution, or uniformity; and no separation of base flow is necessary. The effect of any antecedent moisture condition appears to be evaluated. The regression slope of this peak discharge distribution model is a drainage basin characteristic. Basins with similar slopes should be homogeneous. (Sims-ISWS)
W80-04614

A GENERALIZED PROBABILITY DENSITY FUNCTION FOR DOUBLE-BOUNDED RANDOM PROCESSES,
Institute of Hydraulics and Hydrology, Poondi (India).
For primary bibliographic entry see Field 2B.
W80-04615

ADAPTIVE FOURIER ANALYSIS OF PERIODIC-STOCHASTIC HYDROLOGIC SEQUENCES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 239-249, April 1980. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Streamflow, *Rivers, *Model studies, Mathematical models, Stochastic processes, Fourier analysis, Time series analysis, Correlation analysis, Flow, River flow, Water levels, Discharge(Water), Watersheds(Basins), Drainage, Hydrology, Autocorrelation.

General formulation of adaptive parameter and state estimations was fully developed on the basis of Kalman filters, given a periodic-stochastic model coupled with an observation model. It was successfully applied to decompose a given monthly flow sequence into periodic and stochastic components. The results showed a definite advantage of using adaptive Fourier analysis over conventional analysis. (Sims-ISWS)
W80-04616

CRITICAL DROUGHT ANALYSIS OF PERIODIC-STOCHASTIC PROCESSES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 251-263, April 1980. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Droughts, *Low flow, *River flow, *Streamflow, *Model studies, Mathematical models, Stochastic processes, Analytical techniques, Methodology, Flow, Probability, On-site data collections, Monthly, Measurement, Hydrology, *Turkey.

A general method was presented for finding the exact probability distribution function of the longest drought duration in a finite sample of any process on the basis of runs theory and enumeration technique. The methodology developed was applied to some hypothetical and observed monthly river flow sequences at various parts of Turkey. (Sims-ISWS)
W80-04617

SEDIMENT LOADS OF NORTH ISLAND RIVERS, NEW ZEALAND--A RECONNAISSANCE,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W80-04644

TURBULENCE PREDICTION IN OPEN CHANNEL FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R-M. Li, J. D. Schall, and D. B. Simons.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15347, p 575-587, April 1980. 5 Fig, 2 Tab, 10 Ref, 2 Append. NSF ENG 76-02896.

Descriptors: *Open channel flow, *Turbulence, *Model studies, *Flow characteristics, Turbulent flow, Mathematical models, Dispersion, Diffusion, Theoretical analysis, Analytical techniques, Steady flow, Statistical methods, Laboratory tests, Velocity, Fluctuations, Measurement, Instrumentation, Anemometers, Hydraulics, Probability, Rough boundary, Smooth boundary.

An analytical model for predicting turbulent intensities of velocity for the streamwise and cross-streamwise directions in open channel flow was derived. Due to the random nature of turbulence, a probabilistic approach to the problem is required. A Gaussian distribution was assumed to describe the turbulent fluctuating velocities. From this basic condition, a three-parameter model was derived to predict the root-mean-square (rms) values of turbulence for the vertical and longitudinal directions. Values calculated from the mathematical model were compared to experimentally obtained data using hot-film anemometry techniques, and excellent agreement existed for both components of rms. Field data should be tested to provide a more definite evaluation of the universality of the model. (Humphreys-ISWS)
W80-04645

THE RIVER LAXA ECOSYSTEM, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
P. M. Jonasson.
Oikos, Vol 32, No 1-2, p 306-309, 1979. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *River Laxa(Iceland), *Ecosystems, *Gradients(Streams), *Rivers, Lake Myvatn(Iceland), *Ecological distribution, Spawning, *Powerplants, Fluvial sediments, Upstream, Surface waters, Watersheds(Basins), Fish stocking, River flow, Profiles, Slopes, Zoobenthos, Salmon, Trout, Streams, Iceland, Chironomids, Oligochaetes.

The River Laxa, Iceland, originates in Lake Myvatn and flows into the Atlantic Ocean. It is 58 km long and flows through two different topographic areas: the upper steep part, where the river flows rapidly and where sedimentation does not occur; and the lower part where the slope is gentle, the river flow is slower and sedimentation occurs. A powerplant is located at the juncture of these two stretches. Transport of organic material produced in Lake Myvatn amounts to an average 600 kg dry weight/sec. Downstream movement of organic matter declines rapidly from 3.68 mg dry weight/l near the lake to 2.56 mg dry weight/l about halfway down the river to 1.15 mg dry weight/l near the entry into the ocean. A sharp reduction in chlorophyll occurs in the upper river. The upper river is abundant in Simuliidae, Hydra, Plumatells, chironomids and oligochaetes. Quantitative measures of zoobenthos were not made. However, high concentrations of ducks and trout feeding on zoobenthos in the uppermost reaches of the river indicate that zoobenthos is abundant

there. The lower river is an outstanding salmon river with the highest average catch of 2,200 individuals/year, and the highest average weight of 5.0 kg for Salmo salar L. in Iceland. Since the salmon cannot pass the canyon at the power plant and reach the upper river, the upper reaches have trout, Salmo trutta L. instead. The experimental release of salmon parr in the upper river proved successful, probably because the lava blocks forming the river bed at those locations are a favorable salmon habitat. (Harris-Wisconsin)
W80-04663

ANALYSIS OF STRUCTURAL AND NONSTRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-04772

2F. Groundwater

AQUIFER COEFFICIENTS DETERMINED FROM MULTIPLE WELL EFFECTS, FERNANDINA BEACH, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
C. B. Bentley.
Ground Water, Vol 17, No 6, p 525-531, November-December 1979. 6 Fig, 3 Tab, 4 Ref.

Descriptors: *Aquifer characteristics, *Artesian wells, *Florida, *Water level fluctuations, Pumping, Observation wells, Confined water, Groundwater, Drawdown, Transmissivity, Storage coefficient, Groundwater recharge.

On September 30, 1977, a large industrial plant in Fernandina Beach, Florida, shut down six artesian wells that had been pumping continuously for several weeks from the Floridan aquifer. Two wells continued pumping until November 20, 1977, at which time the shutdown wells were restarted. A water-level recorder on an observation well recorded the changing water level following shutdown and startup. Pumping rates of the wells ranged from 400,000 to 590,000 cubic feet per day. Distances from the pumped wells to the observation well range from 660 to 7,920 feet. Analysis of the water-level data was complicated because the wells were neither turned off nor restarted simultaneously; during recovery one well was restarted and pumped for several hours; and at the beginning of startup, a well that had been pumping continuously during the shutdown was turned off. The Cooper-Jacob graphical method, based on the principle of superposition and using values of specific drawdown or specific recovery and weighted logarithmic mean of the distance squared divided by time was applied to determine the aquifer coefficients for the upper water-bearing zone of the aquifer. A transmissivity of 30,000 feet squared per day and a storage coefficient of between 0.00025 and 0.0004 were computed. (Kosco-USGS)
W80-04554

AQUIFERS IN WALWORTH COUNTY, SOUTH DAKOTA,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04555

ROLE OF BOREHOLE GEOPHYSICS IN DEFINING THE PHYSICAL CHARACTERISTICS OF THE RAFT RIVER GEOTHERMAL RESERVOIR, IDAHO,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-04559

HYDROLOGY AND SURFACE MORPHOLOGY OF THE BONNEVILLE SALT FLATS AND PILOT VALLEY PLAYA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. C. Lines.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Water-Supply Paper 2057, 1979. 107 p, 47 Fig, 7 Tab, 39 Ref.

Descriptors: *Hydrology, *Lake morphology, *Great Salt Lake, *Utah, *Playas, Deserts, Topography, Salinity, Hydrologic budget, Climatology, Groundwater, Aquifer characteristics, Brines, Potash, Mud flats, Groundwater recharge, Discharge(Water), Water chemistry, Evaporation, *Bonneville Salt Flats(Utah), *Pilot Valley(Utah).

The salt crust on the Bonneville Salt Flats, Utah, has been used for many years for racing and for the production of potash. There is a conflict between users, as the salt crust has diminished in size. Brine in the shallow sediments is drained into ditches adjacent to the Bonneville Racetrack, and the brine is used to produce potash. Because brine is extracted from leased Federal and State lands and from privately owned land, there is also concern as to whether minerals were being extracted from unleased Federal and State lands. A hydrologic study indicates that the Bonneville salt crust is being affected by a number of factors including (1) natural climatic cycles, (2) extraction of brine from the ditches, and (3) manmade surface-drainage barriers (tailings piles along ditches and highway roadfills) and ponding areas where sediment is accumulating on the surface of the salt crust. Remedial measures that are evaluated include (1) construction of subsurface barriers, (2) construction of new and alteration of old surface-drainage barriers, (3) cease brine withdrawals in areas near the Bonneville salt crust and move ditch systems further from the salt-crust area, and (4) replace the salt removed by the brine-collection ditches with salt stored in the evaporation ponds used to produce the potash, or with salt from some other source. (Kosco-USGS)
W80-04563

GROUND-WATER BASIC DATA FOR RANSOM AND SARGENT COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04564

HYDROGEOLOGIC AND GEOCHEMICAL INVESTIGATION OF THE BOONE-ST. JOE LIMESTONE AQUIFER IN BENTON COUNTY, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Geology.
A. E. Ogden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175177, Price codes: A09 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas Publication No 68, 1980. p 143, 36 Fig, 5 Tab, 69 Ref, 3 Append, 2 Maps. OWRT A-044-ARK(1).

Descriptors: *Arkansas, *Aquifer characteristics, *Hydrogeology, *Groundwater, Water quality, Well data, Limestones, Permeability, Specific capacity, Transmissivity, Karst hydrology, Caves, Groundwater recharge, Water pollution, Water table aquifers.

Results from thirty-nine pumping tests and well samples were used to study the hydrogeology and hydrochemistry of an important shallow, surface exposed aquifer in northwest Arkansas, the Boone-St. Joe limestone aquifer. The aquifer has two formations, the upper Boone Limestone, and the lower St. Joe Limestone. Parameters determined by the pumping tests include permeability, coefficient of transmissibility, and specific capacity. Coefficient of transmissibility results varied from 24.8 to 24,640 gpd/ft and specific capacity ranged from 0.03 to 30 gpm/ft showing a large range in production capability. Results also indicate that choosing well sites along photo-lineaments is not as reliable for the Boone-St. Joe aquifer as for other karstified carbonate aquifers. Six classes of aquifer conditions were identified for the Boone-St. Joe: (1) wells intersecting caves with rapid recharge; (2) wells intersecting caves with slow recharge; (3) aquifer permeability charges within the saturated zone; (4) delayed yield or leaky conditions; (5) wells intersecting recharge boundaries; and (6) wells in homogeneous aquifer conditions. Groundwater from the aquifer is poor showing high fecal streptococcus counts and high levels of nitrates, chloride, phosphate and sulfate. (Seigler-IPA)
W80-04603

A FINITE-ELEMENT MODEL FOR CONCURRENT CONFINED-UNCONFINED ZONES IN AN AQUIFER,
Indian Inst. of Tech. Madras. Hydraulic Engineering Lab.
K. Elango, and K. Swaminathan.
Journal of Hydrology, Vol 46, No 3/4, p 289-299, April 1980. 10 Fig, 2 Tab, 7 Ref, 1 Append.

Descriptors: *Finite element analysis, *Aquifers, *Confined water, *Groundwater, Mathematical models, Steady flow, Dupuit-Forchheimer theory, Anisotropy, Heterogeneity, Equations, Permeability, Saturated flow, Galerkin technique.

The numerical simulation of the situation of concurrent confined and unconfined zones in a groundwater aquifer system was carried out by using the finite-element method with four-sided mixed-curved isoparametric elements. The model was limited to the steady state and was based on Dupuit's assumptions. The results of the model for a test situation indicated that the model can be used for prediction of the occurrence of unconfined regions around over-pumped wells in an originally confined aquifer of which the interfaces between the confined and unconfined regions may be estimated. (Visocky-ISWS)
W80-04619

THE INTERPRETATION OF TRITIUM IN THE CHALK UNSATURATED ZONE,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
S. S. D. Foster, and A. Smith-Carington.
Journal of Hydrology, Vol 46, No 3/4, p 343-364, April 1980. 8 Fig, 4 Tab, 20 Ref.

Descriptors: *Tritium, *Limestones, *Unsaturated flow, *Fallout, Nuclear explosions, Rainfall, Sampling, Groundwater movement, Soil profiles, Pore water, Solutes, Depth, Porosity, Boreholes, Soil moisture, Moisture content, *Chalk aquifer, *England.

Pore-water tritium profiles from the Chalk unsaturated zone were presented, and the problems and limitations in their interpretation were evaluated in detail. A new model of the physicochemical behavior of tritium in the soil zone was proposed, which can account for the quantity and distribution of thermonuclear tritium observed at shallow depths in the unconfined Chalk aquifer. The mechanisms of solute movement through the Chalk unsaturated zone were also discussed. (Visocky-ISWS)
W80-04621

EFFECT OF CLIMATE AND TEMPERATURE ON THE AMOUNT OF HC03(-) AND H2C03 OF GROUNDWATERS (INFLUENCE DU CLIMAT, DE LA TEMPERATURE SUR LA TENEUR EN HC03(-) ET H2C03 DES EAUX SOUTERRAINES),
H. J. Schoeller.
Journal of Hydrology, Vol 46, No 3/4, p 365-376, April 1980. 2 Fig, 17 Ref.

Descriptors: *Groundwater, *Water quality, *Aquifers, *Model studies, Mathematical models, *Analysis, Analytical techniques, Aquifer characteristics, Temperature, Evapotranspiration, Ions, Calcium, Carbonates, Bicarbonates, Hydrogeology, Limestones, Saturated soils, Arid climates, Climates, Humid climates, Cold regions, Unsaturated soils.

An equation was developed that demonstrates the influence of P sub C02, Ca(2+), T, ionic strength, and complex ions on the amount of HC03(-) in

groundwater. Other constraints are the rate of C02 generation in the soil zone, its behavior in the unsaturated and saturated zones, and the hydrodynamic characteristics of the aquifer. In a limestone aquifer in humid regions, HC03(-) water increases slightly toward the areas of warmer temperatures, and also within the same region the HC03(-) decreases as the altitude increases. The HC03(-) concentration in a dolomitic terrane may be lower than that found in a limestone aquifer in a cold region. In arid climates the mineral content of the water increases which results in higher ionic strengh and HC03(-) concentration due to the rapid rate of evapotranspiration. However, the previous conclusions do not apply when the concentration of Ca(2+) is high, or undersaturation of CaC03 occurs, or for water in terranes of siliceous or silicate rocks. Thus, in a statistical method to describe the relationship between climate and HC03(-) of water, all of the above considerations have to be considered. (Humphreys-ISWS)
W80-04623

HYDROGEOLOGY OF THE PEERLESS LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 7C.
W80-04646

2G. Water In Soils

CONSTRUCTION AND PERFORMANCE OF LARGE AUTOMATIC (NONWEIGHING) LYSIMETERS,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
For primary bibliographic entry see Field 2D.
W80-04528

RESPONSE FUNCTIONS APPLIED TO A DRAINAGE SYSTEM,
National Council for Scientific Research, Lusaka (Zambia).
T. C. Sharma.
Journal of Hydrology, Vol 45, No 3/4, p 279-287, February 1980. 2 Fig, 5 Ref.

Descriptors: *Theoretical analysis, *Agricultural runoff, *Mathematical studies, *Drainage systems, Drainage, Infiltration, Runoff, Analysis, Soil water movement, On-site data collections, *Response functions, Functions.

Response functions such as the impulse, step, and frequency functions may be useful as performance parameters for agricultural land drainage systems. Mathematical expressions have been developed for these response functions from the discrete dynamic representation of a drainage system. (Adams-ISWS)
W80-04530

PHYSICAL PROPERTIES OF CONFINED DREDGED MATERIALS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 1B.
W80-04539

SIMPLE FIELD METHODS FOR ESTIMATING SOIL HYDRAULIC CONDUCTIVITY,
Sao Paulo Univ. (Brazil). Center for Nuclear Energy in Agriculture.
For primary bibliographic entry see Field 7B.
W80-04540

PHYSICAL PROPERTIES OF SOIL MOISTURE,
North Dakota Univ., Grand Forks. Dept. of Physics.
J. W. Harrell, and F. L. Howell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175367, Price codes: A03 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Fargo. Research Project Technical Completion Report, December 1979. p 36, 16 Fig, 14 Ref. OWRT A-051-NDAK(3).

Descriptors: *Kaolinite, *Montmorillonite, *Clays, *Soil moisture, *Soil physical properties, Calcium, Sodium, Soil water movement, Soil water, Moisture content, Analytical techniques, Diffusion, Centrifugation, Tritium, Correlation analysis.

Proton NMR and diffusion coefficient measurements were used to study the mobility of sorbed water in Na- and Ca-montmonillonite, Na-and Ca-hectorite, and untreated kaolin. Clay samples were obtained from Ward's Natural Science Establishment, Inc. The montmorillonite and hectorite were saturated by adding a two molar chloride salt solution of either Na or Ca followed by three cycles of shaking, centrifuging, and pouring off the supernatant. Two hydrating methods were used. In the first samples were saturated and air dried while in the second saturated samples were equilibrated at a fixed moisture tension. Sample measurements taken include relaxation rate, pulse gradient diffusion, and tritium diffusion. Results show the measured room temperature spin-lattice, T(1), and spin-spin relaxation time, T(2), as functions of water content at room temperature. For montmorillonite T(1) and T(2) increase with water content with larger relaxation times in sodium clay when moisture is above 80%. Montmorillonite and hectorite had qualitatively similar temperature dependent spin-lattice relaxations. Correlation frequencies for the proton motion from these values were intermediate between those for pure water and ice. Mean proton jump distances were calculated from two to three times the diameter of a water molecule. For kaolin, T(1) and T(2) increase with water content. (Seigler-IPA)
W80-04606

SOIL-WATER RETENTION, TRANSMISSION, AND QUALITY OF LEACHATE FROM POLYMER-TREATED SOILS, EFFECTS OF THE IN SITU CROSSLINKING,
North Dakota State Univ., Fargo. Dept. of Soils.
J. L. Richardson, S. P. Pappas, E. J. Deibert, and Z. W. Wicks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175342, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University Research Project Technical Completion Report, October 1979. p 12, 4 Append. OWRT A-059-NDAK(1).

Descriptors: *Soil amendments, *Soil properties, *Polymers, *Erosion control, Clays, Loam, Silts, Infiltration, Aggregates, Slope stabilization, Permeability, Soil stability, Soil texture, Soil treatment.

Clay, silt loam, and fine sandy loam were treated with various two-phase crosslinkable polymer systems and with polyvinyl alcohol (PVA) to study their effects on selectd soil characteristics. Surface samples of the three soil types were taken in North Dakota and were analyzed for primary particles size distribution, natural water stable aggregate size distribution, percent organic carbon, and percent calcium carbonate equivalent. Samples were then treated with a variety of types and concentrations of amines and aldehydes of the two-phase crosslinkable polymer system. Some samples were treated with PVA and water to compare treatment effectiveness and to serve as a control. Following treatment four basic tests to determine the quality of soil aggregates on natural soils were preformed: (1) plant available water holding capacity; (2) saturated hydraulic conductivity; (3) water stable aggregate size distribution; and (4) water drop penetration tests to measure water repellency. Results show that the degree of aggregation increases with higher molecular weights and amine/aldehyde system concentrations especially for silts and sands, however, at lower concentrations PVA was more effective than the polymer systems. Variable results were observed for plant water available according to treatment, concentrations and soil type. None of the polmer systems treated cause water repellency but some PVA treated soils moderately repellent. (Seigler-IPA)
W80-04609

SIMULATION OF THE EFFECTS OF TRANSPIRATION LOSSES FROM THE UNSATURATED ZONE ON SEEPAGE FROM A SOIL SLOPE,
Jonkershoek Forestry Research Station, Stellenbosch (South Africa).
P. A. Kilpatrick.
Journal of Hydrology, Vol 46, No 3/4, p 301-309, April 1980. 4 Fig, 3 Tab, 3 Ref.

Descriptors: *Model studies, *Transpiration, *Seepage, *Unsaturated flow, Soil water movement, Streamflow, Mathematical models, Numerical analysis, Finite element analysis, Porous media, Hydraulic conductivity, Moisture content, Pressure head, Saturated flow.

In this study the program UNSAT 1 was used to simulate the drainage of water from a uniform soil on a hillslope so as to investigate the effects of extraction of water from the unsaturated zone. UNSAT 1 uses a Galerkin-type finite-element method to solve the partial differential equation for flow in a saturated-unsaturated porous medium. The results suggest that: (1) The response of the flow system to extractions from the unsaturated zone is fast enough for a diurnal fluctuation in transpiration from the unsaturated zone to cause a diurnal fluctuation in streamflow. (2) A reduction in streamflow caused by a transpiration loss from the unsaturated zone will be much smaller than the transpiration loss. These inferences are tentative because of the following limitations of this study: (1) Material balance errors are of the same order of magnitude as the reductions in seepage outflow. (2) Constant rates of extraction were used. (3) Only one soil type was used. (Humphreys-ISWS)
W80-04620

AN AUTOMATIC ELECTRICAL RESISTANCE SOIL-MOISTURE MEASURING SYSTEM,
Kansas Univ., Lawrence.
T. H. L. Williams.
Journal of Hydrology, Vol 46, No 3/4, p 385-390, April 1980. 3 Fig, 7 Ref.

Descriptors: *Soil moisture meters, *Instrumentation, *Calibrations, Soil moisture, Resistance, Physical properties, Electrical resistance, Electrical properties, Measurement, Gypsum, Gypsum resistance blocks.

The design, calibration, and operation of a reliable yet simple automatic scanning and recording electrical resistance system for the measurement of soil moisture were described. The electrical resistance soil-moisture measuring block utilizes two electrodes separated by some insulating porous material. The material takes up water when placed in contact with the soil until the moisture tension within it equilibrates with the moisture tension in the soil. Subsequent changes in the soil-moisture tension are reflected in variations in the moisture content of the block. The electrical resistance between the electrodes of the block is related to its moisture content and, therefore, a calibration curve of soil moisture vs. block resistance can be constructed. Three types of resistance block are in common use, employing either gypsum, fiberglass, or nylon as the insulating material. The system described was based on the gypsum block but will work equally well with the other types. The system has operated successfully in a field site for two years without problems. The linearity of the calibration curve is retained down to low battery voltages, and the gradient of the curve varied by less than 5% over a period of two years. Measurement accuracy is better than 3%. The system is substantially independent of variations in temperature, the reference resistances having temperature coefficients of 0.05% per degree Celcius. (Humphreys-ISWS)
W80-04622

A STUDY OF STRONTIUM-90 MOVEMENT IN A SANDY SOIL,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de

Radio-Agronomie.
For primary bibliographic entry see Field 7B.
W80-04637

CHLORIDE DISPLACEMENT BY WATER IN HOMOGENEOUS COLUMNS OF THREE SOILS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
B. S. Ghuman, and S. S. Prihar.
Soil Science Society of America Journal, Vol 44, No 1, p 17-21, January-February 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Leaching, *Soil water movement, *Dispersion, Salts, Chlorides, Infiltration, Soil water, Wetting, Soils, Soil types, Laboratory tests, Equations, Soil moisture, Soil science, Chloride displacement, Convection-diffusion equation.

The comparative effects of soil texture on solute profiles during miscible displacement of noninteracting electrolytes are not available in the literature. The displacement of a surface slug of chloride during infiltration and redistribution of water in columns of loamy sand, sandy loam, and silt loam soils was studied. For air-dry soil, maximum solute concentration occurred at the wetting fronts in sandy loam and silt loam but lagged behind the front in the loamy sand. Nevertheless, the position of the solute front coincided with the wetting front in all three soils. After redistribution, the salt peak for v = 1.0 cm/hour was located several centimeters behind the wetting front in the air-dry loamy sand, but coincided with the wetting front in air-dry sandy loam and silt loam. In initially moist soils the salt peak lagged behind the wetting front in all soils. While the depth of chloride peak was not affected by initial soil wetness (theta sub 1) in sandy loam and silt loam, in the loamy sand the salt peak occurred at shallower depth with theta sub 1 = 0.10 than with theta sub 1 = 0.07 cu cm/cu cm. An analytical solution of the solute transport equation described reasonably well the shape and location of chloride slug immediately after its displacement with a given rate and amount of water. When infiltration and redistribution times were matched, water applied at v = 1.0 cm/hour (or ponding in silt loam) moved the salt deeper than v = 0.1 cm/hour in sandy loam and silt loam soils. But in the loamy sand the reverse was true because the redistribution water after the faster application moved through larger pores without taking along the salt. (Sims-ISWS)
W80-04639

EFFECT OF SIMULATED ACID RAIN ON SULFATE MOVEMENT IN ACID FOREST SOILS,
Norwegian Forest Research Inst.
For primary bibliographic entry see Field 2B.
W80-04640

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
M. J. Lindstrom, and W. B. Voorhees.
Soil Science Society of America Journal, Vol 44, No 1, p 84-88, January-February 1980. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Compaction, *Runoff, *Infiltration, *Farm management, On-site investigations, Simulated rainfall, Porosity, Soils, Soil properties, Erosion, Soil erosion, Erosion control, Agriculture, Tillage systems, Tillage practices, Residue, Random roughness, Rainfall erosion index, Interrow zone, Wheel traffic.

Simulated rainfall trials were conducted in wheel-tracked and nonwheel-tracked interrows for three row crop tillage systems (fall moldboard plow with spring disk and harrow, fall chisel with spring disk and no till) at three locations in the northwestern Corn Belt to determine the effect of wheel traffic from the planting operation on interrow runoff and infiltration. Roughness and total porosity differences were noted between the tillage systems and wheel-track variable. Simulated rainfall was applied with a sprinkling-type infiltrometer at a rate of 12.7 cm/hour simultaneously to wheel-tracked and nonwheel-tracked interrows. Differences in energy, reported as rainfall erosion index (EI), to initiate runoff between tillage systems were observed, but these differences were not uniform between locations. In general, the tilled systems required a higher EI to initiate runoff than the no-till system. In paired comparisons, the nonwheel-tracked interrow required a higher EI to initiate runoff and had a higher infiltration rate during runoff than did the wheel-tracked interrow at all locations on all tillage systems. Results from this study suggested that the frequency of interrow traffic must be considered in the design of tillage systems for water conservation and erosion control. (Sims-ISWS)
W80-04641

NITROGEN AND WATER DISTRIBUTIONS IN FERTILIZED SANDY SOIL DURING IRRIGATION AND DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, H. M. Selim, D. V. Calvert, E. H. Stewart, and L. H. Allen.
Soil Science Society of America Journal, Vol 44, No 1, p 95-102, January-February 1980. 9 Fig, 2 Tab, 12 Ref. EPA R800517.

Descriptors: *Nutrients, *Drainage, *Subsurface drainage, *Water quality, *Florida, Acidic soils, Sands, Nitrogen, Water pressure, Soil water, Soil water movement, Drains, Linings, Subsurface drains, Fertilizers, Agricultural chemicals, Agriculture, Cultivation, Spodosol.

Nutrients applied to citrus growing in subsurface-drained acid, sandy soils of Florida are subject to movement through the soil and possible loss through drainage water especially after intense rainfall. The primary objective of this investigation was to determine the spatial distributions of soil water pressure head and concentrations of nitrogen (N03-N and NH4-N) in the soil solution after fertilization and irrigation of citrus in a subsurface-drained Spodosol. The soil treatments were: (1) shallow tillage and shallow liming (ST), and (2) deep tillage and deep liming (DTL). Tensiometers and solution sampler cups were placed at several soil depths and lateral distances on either side of a subsurface drain. Results showed transport of water and nutrients in the ST soil was rapid relative to DTL soil. Two-dimensional contours of equal soil-water pressure revealed that, after a 3.4-cm irrigation, slower drainage in DTL soil relative to ST raised the water table near the soil surface (to within 30 cm), of the DTL soil, whereas the water table in the ST soil rose to only about 80 cm from the soil surface. Observed distributions of N03-N and NH4-N concentrations in the soil solution exhibited considerably higher spatial variability than soil water pressure head distributions for both soils. Concentrations of N03-N were always higher than NH4-N in either soil. Rates of drainage were higher for ST than DTL soils. Over a 2-week period, the amount of N03-N in the drainage water from ST soil was four times greater than from DTL soil. It was concluded that N03-N was less susceptible to leaching loss in the DTL soil than in the ST soil. (Sims-ISWS)
W80-04642

2H. Lakes

EFFECTS OF CHANGES IN DRAINAGE-BASIN BOUNDARIES ON SEDIMENTATION IN EOCENE LAKES GOSIUTE AND UINTA OF WYOMING, UTAH, AND COLORADO,
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-04541

PHOTOSYNTHESIS AND GROWTH OF SPIRULINA PLATENSIS (CYANOPHYTA) IN AN EQUATORIAL LAKE (LAKE SIMBI, KENYA),
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W80-04647

THE CHEMISTRY OF LAKE MYVATN AND RIVER LAXA,
Marine Research Inst., Reykjavik (Iceland).
For primary bibliographic entry see Field 5C.
W80-04657

LIMNOLOGICAL STUDIES IN MONTANA: HYALITE RESERVOIR AND RESPONSES OF LOTIC PERIPHYTON TO DEEP-WATER DISCHARGES, GRAZING AND LOGGING,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 4C.
W80-04670

NORTHERN LAKE MODELING: A LITERATURE REVIEW,
Alaska Univ., Fairbanks. Inst. of Water Resources.
P. M. Fox, J. D. LaPerriere, and R. F. Carlson.
Water Resources Research, Vol 15, No 5, p 1065-1072, October 1979. 4 Tab, 118 Ref. OWRT C-6169 (No 5217)(2), 14-31-0001-5217.

Descriptors: *Lakes, *Model studies, *Mathematical models, *Reviews, Cold regions, Subarctic, Temperature, Water temperature, Ice, Snow, Water quality, Algae, Zooplankton, Fish, Water chemistry, Publications, Northern lakes.

While there are many diverse temperate lake models available, there are none which are comprehensive annual northern lake models. Northern lakes are those which lie above 40 deg N latitude, have continuous winter ice cover, and experience large seasonal differences in daylight patterns. Therefore, it is necessary to review the temperate ecosystem and smaller process models along with reported field studies to assess model adequacy for northern application. While most northern lake processes have been described in the literature, there is little agreement between investigators as to specific formulations. However, lake modeling can be a viable tool in northern lake utilization studies provided certain precautions are taken. When using the various formulations presented in this review to develop and apply a model, all assumptions of each component should be considered. Also, the uncertainty in the data and model should be incorporated or at least considered with the resulting estimates. (Sims-ISWS)
W80-04677

2I. Water In Plants

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4A.
W80-04512

RADIO-MANGANESE, -IRON, AND -PHOSPHORUS UPTAKE BY WATER HYACINTH AND ECONOMIC IMPLICATIONS,
University of South Florida, Tampa.
T. N. Cooley, M. H. Gonzalez, and D. F. Martin.
Economic Botany, Vol 32, No 4, p 371-378, October-December 1978. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Water hyacinth, *Phosphorus, *Iron, *Manganese, *Plant physiology, *Nutrient removal, Kinetics, Nutrients, Nutrient requirements, Tracers, Root distribution, Leaves, Sewage treatment, Sewage lagoons, Water quality, Economics, Rates, Density, Metabolism.

Manganese, iron and phosphorus are all actively absorbed by water hyacinth (Eichhornia crassipes) root systems; however, rates of absorption and translocation differ markedly. Absorption rates of manganese by roots are considerably greater than values for phosphorus or iron. The rate of manganese uptake in roots is 13 and 21 times that for radio-iron, and -phosphorus, respectively. Iron is

taken up by roots at nearly twice phosphorus rates. Phosphorus and manganese rapidly appear in leaves, whereas iron begins to appear slowly in leaves only during the first 21 days. Translocation of iron is slow (manganese rates are 65 times that for iron), and manganese translocation is faster than that of phosphorus by an order of magnitude. Amounts of elements taken up by water hyacinths are calculated to be 7.80 mg P/plant, 5.73 mg Mn/plant and 0.40 mg Fe/plant for one week for plants with mean weights of 3.5 g dwt. Estimates are also made for the amount of phosphorus that is removed from treated sewage by water hyacinth plants. With 18 plants/sq m density, a typical facility processing 3.8 million l treated sewage requires 8,190 sq m surface area and 0.5 m mean depth. With 1 microg P/ml available phosphorus present, about 71% of the available phosphorus can be removed in two weeks. Water hyacinths with 50 plants/sq m density, remove 209 kg P/ha yr; with 500 plants/sq m, 2,093 kg P/ha yr is removed. Water hyacinth utilization to remove selected trace elements can aid sewage treatment and help prevent polluted lakes and streams. (Danovich-Wisconsin)
W80-04649

DAMS AND WILDLIFE,
Wisconsin Univ.-Eau Claire. Dept. of Biology.
R. E. Lewke.
Passenger Pigeon, Vol 40, No 3, p 429-442, Fall, 1978. 6 Fig, 3 Tab, 9 Ref. OWRT A-054-WASH(4), 14-31-0001-3848.

Descriptors: *Riparian waters, *Dams, *Birds, *Ecological distribution, *Environmental effects, Ecology, Impoundments, Rivers, Post-impoundment, Banks, Wetlands, Reservoirs, Flood plains.

Nearly 100 percent of the Lower Snake River flood plain between Lower Granite Dam and Clarkston, Washington, was inundated in February, 1975. Of the area inundated, 16 percent represented valuable riparian habitat and 84 percent represented weedy flood plain habitat. Evidence indicated that most displaced birds would not be able to re-establish themselves in remaining above-pool habitats, and that the loss of below-pool habitats would indirectly cause a decrease in the number of birds remaining in above-pool habitats. Of the 129 bird species observed in the study area before inundation, 50 percent were found to be significantly dependent upon the riparian physiognomic type. Impoundment was estimated to cause the loss locally of over 14,000 birds in summer and 30,000 in winter. Migrant species of birds, excluding waterfowl, did not utilize the Lower Snake River Canyon habitats to a great degree and thus will not be affected nearly as much as permanent, summer, and winter resident species. Since different species will not be affected equally by habitat loss, population density of each species will decline disproportionately. (Howard-Mass)
W80-04678

2J. Erosion and Sedimentation

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: III. A CONCEPTUAL MODEL FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04515

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-04516

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
For primary bibliographic entry see Field 4C.
W80-04519

FERTILIZER NUTRIENT LOSSES FROM RANGELAND WATERSHEDS IN CENTRAL OKLAHOMA,
Science and Education Administration, Durant, OK.
For primary bibliographic entry see Field 5B.
W80-04520

COMPUTATION OF BED LOAD USING BATHYMETRIC DATA,
National Water Research Inst., Burlington (Ontario), Hydraulic Research Div.
P. Engel, and Y. L. Lau.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY3, Proceedings Paper 15255, p 369-380, March 1980, 5 Fig, 2 Tab, 16 Ref, 2 Append.

Descriptors: *Bathymetry, *Sediment load, *Bed load, Bed load samplers, Sediment transport, Surveys, Hydraulics, Sedimentation, Sediment discharge, *Bed forms, Bed load movement, Bed load transport.

A method of calculating bed-load transport was presented. This method takes advantage of the rapid bathymetric surveys that can be made in large rivers. The proposed equation is based on sediment continuity and an assumption for the base level of zero transport. Experimental data were obtained in a series of flume tests, and the measured transport rates were compared with the calculated transport rates using the proposed equation. Comparisons were also made with the Ackers-White equation. (Lee-ISWS)
W80-04534

DEBRIS FLOW ON PRISMATIC OPEN CHANNEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 2E.
W80-04535

EFFECTS OF CHANGES IN DRAINAGE-BASIN BOUNDARIES ON SEDIMENTATION IN EOCENE LAKES GOSIUTE AND UINTA OF WYOMING, UTAH, AND COLORADO,
Wyoming Univ., Laramie. Dept. of Geology.
R. C. Surdam, and K. O. Stanley.
Geology, Vol 8, No 3, p 135-139, March 1980. 3 Fig, 16 Ref. NFS DES72-01461 A01.

Descriptors: *Sedimentation, *Lakes, *Watersheds(Basins), *Wyoming, *Utah, *Colorado, Geomorphology, Evaporation, Groundwater, Surface waters, Recharge, Stratigraphy, *Lake Gosiute, Lake Uinta.

The regimes of early Tertiary Lakes Gosiute and Uinta were strongly affected by pronounced imbalance between evaporation and recharge by surface and groundwater. Both evaporation and recharge were strongly affected by the climate of the closed hydrographic basins where the lakes formed. However, at unique times in the histories of the Lake Gosiute and the Lake Uinta basins, the regimes of these lakes were significantly modified by enlargement of the drainage basins to include water from basins farther north. Evidence for changes in the size of drainage basins includes southward dispersal of volcaniclastic sands containing basaltic to dacitic volcanic rock fragments from the Absaroka volcanic field in northwestern Wyoming. The southward progradation of the resulting sandstone units from the Wind River Basin into the greater Green River Basin and from there into the northern Piceance Creek Basin records the successive depositional filling of closed hydrographic basins so that water and sediment were transported by streams over the lowest divides into the adjacent basins. Filling of these basins allowed large volumes of surface and groundwater to be added first to Lake Gosiute and then to Lake Uinta. The added water resulted in: (1) a rise in lake level, (2) the development of nutrient-rich lakes where algal productivity led to the deposition of precursors of oil shale, and (3) in the case of Lake Uinta, a change in water chemistry such that brines precipitated sodium carbonate rather than calcium sulfate minerals. Basin filling and enlargement of the drainage systems were probably a consequence of tectonic activity and stability of the basins and adjacent uplifts, although climatic conditions that increased sediment yield and runoff in the hydrographic basins also could have hastened their filling. However, it is difficult to explain patterns of evaporite minerals, oil shale, mudstone, and sandstone formed in Lakes Gosiute and Uinta if climate was the dominant factor. (Humphreys-ISWS)
W80-04541

THE EFFECT OF ALTERED STREAMFLOW ON THE HYDROLOGY AND GEOMORPHOLOGY OF THE YELLOWSTONE RIVER BASIN, MONTANA,
Montana Dept. of Natural Resources and Conservation, Helena.
For primary bibliographic entry see Field 2A.
W80-04542

SEDIMENT DISCHARGE AND CHANNEL CHANGE IN THE NORTH FORK TETON RIVER, 1977-78, FREMONT AND MADISON COUNTIES, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. P. Williams.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO. 80225, paper copy $12.50, microfiche $5.00. Geological Survey open-file report 79-1335, October 1979. 81 p, 7 Fig, 10 Tab, 11 Ref.

Descriptors: *Sediment discharge, *Channel erosion, *River flow, *Idaho, *Geomorphology, Dam failure, Floods, Channel improvement, Natural flow, Sediment transport, Deposition(Sediments), Equilibrium, Bank erosion, Bed load, Hydrologic data, *North Fork Teton River(Idaho), *Teton Dam(Idaho).

The Teton Dam failure flood of June 5, 1976, severely disrupted the geomorphic character of North Fork Teton River in Idaho. Extensive channel restoration was required to contain expected normal spring flows. Six principal sites were established on the 17-mile reach of the river to study sediment transport and channel change during 1977-78. During April 1 to September 30, 1977, total water discharge at Teton Island bridge was 97,530 acre-feet; 4,360 tons of total sediment were transported. Total water discharge, April 1 to September 30, 1978, was 191,940 acre-feet; 10,680 tons of total sediment were transported. Analyses of data indicated several trends of erosion and deposition. Minimal channel change in the upper 7 miles of the river indicated equilibrium may temporarily exist between hydraulic-flow properties and channel shape. Streambed profiles indicated little change in streambed elevations. Erosional tonnage at mid-study reaches was 4,260 tons. One-half mile downstream, an increase of 4,150 tons of suspended and 1,050 tons of bedload sediment probably was partly derived from upstream bank erosion. An estimated 5,870 tons was deposited within the next subreach downstream. Virtually the entire bedload was redeposited before the last subreach, 4.4 miles downstream measured bedload was 91 tons. Suspended-sediment discharge transported past the last site was 16,470 tons. Lateral erosion and deposition in the lower 10 miles of the river indicate that subreaches now shortened by man-made channel alinements may begin to meander. Future deposition of coarse material at upstream gravel and concrete impoundments may trigger instability in the entire river. (Kosco-USGS)
W80-04562

RECENT GRADATIONAL AND CHANNEL-MIGRATION HISTORY OF THE KANSAS RIVER -- A GUIDE FOR FLOODPLAIN MANAGEMENT,
Kansas Water Resources Research Inst., Manhattan.
W. Dort, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174501, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, April 1980, p 80, 7 Fig, 40 Ref. OWRT A-083-KAN(1), 14-34-0001-7035.

Descriptors: *Channel morphology, *Channel erosion, Bank stability, Bank stabilization, Meanders, Flood plains, Kansas, *Kansas River, Bank erosion, Bed erosion, Alluvial channels, River regulation, Meander migration, *Channel migration.

Since 1976, studies of the history of migration of 725 channel miles of the Kansas River and major tributaries have proceeded under contract with the Kansas City District of the U.S. Army Corps of Engineers. An 85-mile reach from Topeka to Kansas City has been investigated for the Kansas Water Resources Research Institute. Both projects are continuing. Historical data on channel shape and position have been acquired from published maps judged sufficiently accurate back into the 1850s. Scattered information about prehistoric courses was obtained by analysis of floodplain scrolls and abandoned channels visible on aerial photographs. The Corps has recently published an atlas of 41 maps that display changes in channel position by use of eleven colors. The 125-year record on the Kansas River reveals a spatial alternation of stable and unstable reaches. Some portions of the channel have moved rapidly across the floodplain in complex patterns; other segments have remained absolutely immobile. Locations of movement with the past ten or so years do not all correlate with sites of earlier movement. Sudden migration has locally erupted in areas stable for the preceding century.
W80-04600

NIPS, NOTCHES, AND THE SOLUTION OF COASTAL LIMESTONE: AN OVERVIEW OF THE PROBLEM WITH EXAMPLES FROM GREECE,
California Univ., Davis. Dept. of Geology.
C. G. Higgins.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 15-30, January 1980. 4 Fig, 2 Tab, 48 Ref. ONR Nonr-2211-02.

Descriptors: *Coasts, *Erosion, *Limestone, *Calcium carbonate, Shores, Dissolved solids, Rocks, Freshwater, Saline water-freshwater interfaces, Sea water, Groundwater, Tides, Water levels, Waves(Water), Oceans, *Greece, Coastal erosion, Nips, Notches.

The origins of intertidal indentations and undercuts (nips and notches) in calcareous shores has long been disputed. In recent years this dispute has centered on the efficacy of solution by seawater vs. the erosional effects of marine organisms. Little attention has been given to solution by fresh groundwater even though it is a proven solvent of calcareous rocks whereas seawater is not. The solutional effects of groundwater--either floating as a surface layer on seawater or seeping through porous rocks at the shoreline--would be strictly confined to the intertidal zone and most intense at midtide level. Just such a distribution of erosional effect is required for the formation of nips and notches, yet such a distribution of effect has yet to be demonstrated either for seawater or for most erosional marine organisms. On purely theoretical grounds, then, solution by groundwater deserves consideration as a major factor in the origin of coastal undercuts. In Greece, notches in calcareous rocks occur only in proximity to coastal springs, where surface seawaters are locally diluted by freshwater. Percent saturation of these waters with respect to calcium carbonate is not known, but the one-to-one correspondence of notches with springs is by itself persuasive circumstantial evidence that solution by groundwater is the chief factor in the origin of the notches. (Sims-ISWS)
W80-04628

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W80-04632

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 2G.
W80-04641

RECENT SEDIMENTATION HISTORY OF THE WAIMAKARIRI RIVER, NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div.
G. A. Griffiths.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 6-28, 1979. 10 Fig, 3 Tab, 1 Plate, 25 Ref.

Descriptors: *Sedimentation, *Aggradation, *Gravels, *Degradation(Stream), Rivers, Watersheds(Basins), Erosion, Sediment transport, Meanders, Bank erosion, Mathematical models, Suspended load, Bed load, *New Zealand, Sedimentation history, Kinematic wave model.

The Waimakariri River is one of several large, steep, braided, gravel-bed rivers that rise in the Southern Alps of New Zealand and flow eastwards to the Pacific Ocean. Its upper catchment has a mountainous topography reflecting continuing rapid uplift and extensive glacial and postglacial erosion; in its lower catchment the river is incised into a number of outwash and aggradational surfaces. The transition between downcutting and fan building is currently located about 18 kilometers from the sea. Below the transition, severe aggradation is occurring. Quantitative analysis of river cross-section survey data collected over the past 45 years demonstrates that at least 65% of this aggradational material is derived locally--not from the upper catchment area where the channel is stable. Over the past century the lower catchment channel has been confined over most of its length by regulatory works. There, major changes in sedimentation patterns include the imposition of a broad meander pattern, extensive channel bank erosion, bed degradation and aggradation, and the downstream migration of a gravel tongue. An example was given of a river reach that has translated amounts of gravel far in excess (49 times) of its theoretical bed load transporting capacity while remaining substantially unaltered in width, bed material size, slope, and mean bed level. Much of this gravel is supplied by bank erosion and channel bed degradation; this material moves downstream as channel sediment waves. A mathematical model was presented describing the kinematics of these waves. Long-term, at-a-station, sinusoidal fluctuations in mean bed level on another river were presented as further field evidence for their existence. (Lee-ISWS)
W80-04643

SEDIMENT LOADS OF NORTH ISLAND RIVERS, NEW ZEALAND--A RECONNAISSANCE,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
J. Adams.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 36-48, 1979. 2 Fig, 2 Tab, 25 Ref.

Descriptors: *Suspended load, *Bed load, *Dissolved solids, Watersheds(Basins), Rivers, Sediment transport, Suspended solids, Sediment load, Flow, Sediment yield, Erosion, Erosion rates, River flow, River basins, *Dissolved load, *New Zealand.

Suspended load, dissolved load, and bed load (for 23 catchments only) were calculated by approximate methods for 40 rivers in the North Island. The proportion of each type of load was roughly 88%, 10%, and 2%, but the dissolved load was relatively more important in rivers draining catchments with slight erosion and the bed load more important in rivers draining directly from the eastern mountain ranges. The river catchments, mostly 150 to 1500 sq km in area, had suspended sediment yields ranging from 35 t/sq km/yr to 28,000 t/sq km/yr with the highest yields being from catchments in the East Cape region. (Lee-ISWS)
W80-04644

2K. Chemical Processes

PRECIPITATION ACIDITY: THE ROLE OF THE FOREST CANOPY IN ACID EXCHANGE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
W. A. Hoffman, Jr., S. E. Lindberg, and R. R. Turner.
Journal of Environmental Quality, Vol 9, No 1, p 95-100, January-March 1980. 3 Fig, 2 Tab, 35 Ref. DOE W-7405-eng-26.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Forests, Trees, Oak trees, Leaves, Vegetation effects, Acids, Sulfates, Nitrates, Organic compounds, Hydrogen ion concentration, Sampling, Chemical analysis, Rain, Air pollution, Path of pollutants, Water pollution, Water chemistry, Acid precipitation.

Individual rain events were sampled above and below the forest canopy in Walker Branch Watershed, Tennessee, from August 1977 to June 1978 for the purpose of analysis of acidity and organic content. Strong acid content correlated with sulfate concentrations. Total acid concentrations were conserved as rain penetrated chestnut oak (Quercus prinus L.) canopies, although the strong/weak acid ratio decline substantially. Although weak acids constituted at least 30% of the total acidity of incident rain and increased to over 50% in throughfall, the increase could not be entirely attributed to organic acids. The results of the study support the fundamental importance of ion-exchange models in systematizing rain-vegetation interactions. (Sims-ISWS)
W80-04521

CALCULATION OF THE IN SITU PH OF SEAWATER,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.
W80-04533

GROUNDWATER CHARACTERISTICS AND CORROSION PROBLEMS ASSOCIATED WITH THE USE OF GEOTHERMAL WATER IN KLAMATH FALLS, OREGON,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8G.
W80-04763

PREDICTED CORROSION AND SCALE-FORMATION PROPERTIES OF GEOPRESSURED GEOTHERMAL WATERS FROM THE NORTHERN GULF OF MEXICO BASIN,
Y. K. Kharaka, M. S. Lico, and W. W. Carothers.
Journal of Petroleum Technology, Vol 32, No 2, p 319-324, February, 1980. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Geothermal studies, *Corrosion, *Scaling, Chemical analysis, Gulf of Mexico, Chemical precipitation, Equations, Water chemistry, Chemical reactions.

This paper describes chemical and physical parameters of selected geopressured geothermal water that indicate their potential for corrosion and scaling. Detailed chemical analyses of 120 water samples from depths of 1,000 to 5,600 m show that the salinity of water in the geopressured zones ranges from 10,000 to 270,000 mg/l dissolved solids. Na and Cl generally constitute more than 90% of the total cations and anions, respectively. Corrosion and scale-formation properties of geopressured geothermal water are different from those of waters with similar chemical composition but produced from oil and gas wells. This is due to higher temperatures and withdrawal rates and the absence of oil in geopressured geothermal waters. The high salinity, Cl concentration and temperature increase the corrosivity by facilitating dissolution of iron at

anodic sites. The corrosivity will be controlled by reactions at cathodic sites which are slow due to the almost complete absence of dissolved oxygen, absence of sulfate-reducing bacteria, and low activity of H+. Hydrogen Sulfide corrosion will be minimal because the concentrations of H2S are less than 1 mg/l. Scale formation from precipitation of carbonates of Ca, Sr, and Ba, sulfate of Ba, and oxyhydroxides of iron is likely during production. (Purdin-NWWA)
W80-04766

2L. Estuaries

THE ESTUARY REVISITED,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, and D. J. Hirschberg.
Water Spectrum, Vol 12, No 2, p 1-9, Spring 1980. 10 Fig.

Descriptors: *Estuaries, *Evolution, *Geologic history, *Speciation, Estuarine environment, Estuarine fisheries, Brackish water, Shellfish, Chesapeake Bay, Fjords, Glaciers, Commercial fishing, Fish harvest, Ecosystems, Sedimentation, Saline water-freshwater interfaces.

An intensive literature review was used to assess estuaries which are semi-enclosed coastal bodies of water that are freely connected to the open ocean and are measurably diluted by freshwater from runoff. A range of geological processes form estuaries such as bar-built estuaries, tectonically formed estuaries, fjord estuaries, and submerged river valley estuaries. Estuaries have not persisted throughout geologic time but are formed or destroyed with changes in ocean water level resulting from the advance or retreat of glaciers. All modern estuaries are geologically very young, approximately 10,000 years, and were formed when the present Holocene Interglacial period began. Estuaries have short geologic life spans measurable in thousands or tens of thousands of years. Estuaries are not vital to the survival of species which inhabit them. During past glacial periods when estuaries were rare or absent these organisms must have lived in open, shallow, brackish areas. Also, there is no evidence that estuaries have played a major role in the evolution of marine species. Estuaries are, however, important as fisheries since without them the finfishes and shellfishes harvested by man would not exist in sufficient number for harvesting. Man is the most estuarine-dependent organism, he makes the most demands, and is the only organism capable of managing estuaries to produce their longest biologically and recreationally useful life. (Seigler-IPA)
W80-04505

MIXING PROCESSES ON THE ATLANTIC CONTINENTAL SHELF, CAPE COD TO CAPE HATTERAS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-04532

CALCULATION OF THE IN SITU PH OF SEAWATER,
Delaware Univ., Newark. Coll. of Marine Studies.
C. H. Culberson.
Limnology and Oceanography, Vol 25, No 1, p 150-152, January 1980. 3 Tab, 11 Ref. NSF OCE78-07488.

Descriptors: *Hydrogen ion concentration, *Sea water, *Model studies, Mathematical models, Equations, Oceans, Carbon dioxide, Water temperature, Pressure, Alkalinity, Salinity, Water chemistry, Oceanography.

The in situ pH at oceanic temperatures and pressures was calculated from the exact solution to the cubic equation relating total inorganic carbon dioxide to total alkalinity. The method does not require iteration. The equations for calculating pH from the partial pressure of carbon dioxide and the total alkalinity were also given. (Sims-ISWS)
W80-04533

MAINE COASTAL STORM AND FLOOD OF FEBRUARY 2, 1976,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-04553

LONGSHORE PRESSURE GRADIENTS CAUSED BY OFFSHORE WIND,
Woods Hole Oceanographic Institution, MA.
G. T. Csanady.
Journal of Geophysical Research, Vol 85, No C2, p 1076-1084, February 20, 1980. 8 Fig, 13 Ref, 1 Append.

Descriptors: *Winds, *Currents(Water), *Ocean circulation, Tidal waters, Pressure head, Oceanography, Beaches, Coasts, Friction, Flow, Mathematical models, Model studies, Vortices, Ocean currents, Analytical techniques, On-site data investigations, Theoretical analysis, *Offshore wind, Pressure gradients, Longshore nontidal flow, Ekman drift, Longshore flows.

Observations of currents 12 km south of the Long Island coast show that strong offshore winds could generate considerable longshore nontidal flow well below any surface Ekman drift. A momentum balance calculation in the longshore direction shows a surface level gradient of order 0.000001 to be the proximate cause of the longshore flow. A very simple model of the observed phenomena is a sloping plane beach acted upon by cross-shore wind, varying sinusoidally in the longshore direction. With bottom friction parameterized by a linear law, a parabolic equation is found to govern steady state flow, expressing a balance of vorticity tendencies due to cross-isobath flow, curl of bottom stress, and any forcing. Calculated solutions for variable cross-shore wind show a trapped pressure field on the inner shelf which controls the transition between an essentially frictionless momentum balance on the outer shelf to frictionally dominated flow at the shore. Realistic estimates of the parameters entering the theory suggest that the longshore gradients associated with the trapped inner shelf field are of the correct order of magnitude to explain the generation of longshore flow by a system of cross-shore winds. (Lee-ISWS)
W80-04626

BENTHIC INFAUNAL VARIABILITY ON A TRANSECT IN THE GULF OF MEXICO,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
R. W. Flint, and J. S. Holland.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 1-14, January 1980. 5 Fig, 4 Tab, 34 Ref. BLM AA550-CT6-17.

Descriptors: *Benthic fauna, *Coasts, *Gulf of Mexico, *Texas, Benthos, Biological communities, Marine biology, Continental shelf, Sediments, Sampling, Variability, Temperature, Water temperature, Salinity, Depth, Biology.

Macroinfaunal benthos off the South Texas Coast of the Gulf of Mexico formed different assemblages distributed according to depth: shallow (22 m), mid-depth (36 to 49 m), and deep water (78 to 131 m). Species composition of shallower stations were less diverse, composed of eurytopic and opportunistic species adapted to a fluctuating environment. The deep water benthos, in a more stable environment, had a higher diversity. Sediment composition (high proportions of silt) at the mid-depth stations resulted in dominance of deposit feeders. The environmental gradient was related to a species continuum which changed from polychaete dominated groups in shallow water, to deposit feeding molluscs and crustaceans, to a deep water diverse fauna not dominated by any particular group. Environmental heterogeneity, including climatic variability, may be most important in controlling shallow water benthos. In deeper more stable shelf habitats where diversities are higher and species equilibrium is the case, species interactions may determine community structure. (Sims-ISWS)
W80-04627

NIPS, NOTCHES, AND THE SOLUTION OF COASTAL LIMESTONE: AN OVERVIEW OF THE PROBLEM WITH EXAMPLES FROM GREECE,
California Univ., Davis. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-04628

RECURRING AGGREGATION OF ZOOPLANKTON BY A TIDAL CURRENT,
California Univ., Santa Barbara. Dept. of Biological Sciences.
A. L. Alldredge, and W. M. Hamner.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 31-37, January 1980. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Zooplankton, *Distribution patterns, *Spatial distribution, *Currents(Water), *Australia, Coasts, Shores, Tides, Tidal waters, Tidal effects, Circulation, Water circulation, Velocity, Fish, Benthic fauna, Marine biology, Aggregation.

Zooplankton densities up to 40 times greater than those in adjacent water accumulated in the lee of a small point protruding into a strong tidal current at Whitsunday Island, Queensland, Australia. The density of plankton in the lee was linearly correlated with current velocity past the point, reaching maximum concentrations at mid-flood tide and decreasing as slack tide approached. Zooplankton did not accumulate when tidal flow reversed direction. Possible mechanisms of aggregation were discussed. Mass transport of zooplankton into lees by fine-scale current patterns may be a major cause of plankton aggregation in some near-shore localities and may significantly affect the distribution of fish and benthic invertebrates. (Sims-ISWS)
W80-04629

A ONE-DIMENSIONAL REPRESENTATION OF RESIDUAL CURRENTS IN THE SEVERN ESTUARY AND ASSOCIATED OBSERVATIONS,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 39-60, January 1980. 9 Fig, 1 Tab, 22 Ref.

Descriptors: *Estuaries, *Tides, *Water circulation, *Water balance, *Model studies, Mathematical models, On-site investigations, Measurement, Water levels, Circulation, Currents(Water), Energy, Energy budget, Tidal waters, Coasts, *Severn Estuary(England), *England.

A one-dimensional hydrodynamical model was used to describe the cross-sectionally averaged Stokes drift and Eulerian residual (tidally averaged) currents in a section of the Severn Estuary between Porthcawl and Sharpness. Residual variables were computed for periodic M sub 2 tides, and as functions of time during simulated spring-neap cycles. The results for periodic M sub 2 tides showed that the landward directed Stokes drift has a spatially averaged value of 3.5 cm/s in the Severn Estuary, which, in the absence of freshwater inputs and meteorological perturbations, is balanced by seaward flowing Eulerian residual currents. The residual setup of water (i.e., the mean surface elevation relative to the value at the seaward boundary) is mainly determined by the magnitudes of the axial density gradients and friction, with the friction dominating for typical salinity distributions; the landward flow of water due to the Stokes drift contributes to the setup, which drives the seaward residual currents against the opposing frictional forces. It was shown that the magnitude of the Stokes drift is mainly determined by the estuary's geometry, the strength of the tidal streams, and the friction (regardless of whether a quadratic or linearized friction law is assumed), the effects of density gradients and axial momentum advection and dispersion being negligible. The computed values of the Stokes drift were compared with observations at nine anchor stations and covering 28 tidal cycles; the agreement between observations and theory was generally good. (Sims-ISWS)

W80-04630

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5B.
W80-04632

SHORT-TERM VARIATIONS IN PHYTOPLANKTON BIOMASS IN A TIDAL ESTUARY IN NORTHERN BRITTANY,
Station Biologique de Roscoff (France).
C. Riaux, and J-L. Douville.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 85-92, January 1980. 4 Fig, 4 Tab, 22 Ref.

Descriptors: *Phytoplankton, *Variability, *Estuaries, *Tidal waters, Chlorophyll, Salinity, Water temperature, Water levels, Biomass, Plankton, Tides, Tidal effects, Hydrodynamics, Sampling, Model studies, Mathematical models, *Penze Estuary(France).

Seasonal and short term variations in phytoplankton biomass were examined in the Penze estuary (Northern Brittany) from June 1975 to July 1976. A simple model was proposed to characterize the seasonal variation of chlorophyll a concentration from June 1975 to June 1976. The tidal cycle seems to induce diurnal variations which may be very important in summer in the upper part of the river. Chlorophyll a concentration increases towards low tide and correlates with salinity and water level. (Sims-ISWS)
W80-04633

LONG-PERIOD GRAVITY WAVES IN ICE-COVERED SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-04634

WAVE SETUP OF HARBOR WATER LEVELS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
R. O. R. Y. Thompson, and B. V. Hamon.
Journal of Geophysical Research, Vol 85, No C2, p 1151-1152, February 20, 1980. 1 Ref.

Descriptors: *Waves(Water), *Harbors, *Water levels, Oceanography, Sea level, Estuaries, Oceans, Gages, Mathematical models, Theoretical analysis, *Wave setup, Radiation stress, Surface waves.

Radiation stress by incoming sea surface waves or swell can raise the mean level of water in a harbor by an amount independent of the size of the harbor. This setup can be a significant confounding factor in determining sea level changes if the sea level gage is inside a harbor with a moderately shallow entrance. The mechanism is independent of 'inverse barometer' or wind setup effects, though it is likely to enhance them. (Lee-ISWS)
W80-04638

THE EFFECT OF SEWAGE EFFLUENT ON THE STRUCTURE AND FUNCTION OF A FRESHWATER TIDAL MARSH ECOSYSTEM,
Rider Coll., Trenton, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W80-04674

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING: AN OFFER YOU MAY NOT REFUSE,
Office of Water Research and Technology, Washington, DC.
W. H. McCoy.
Water Spectrum, Vol 12, No 2, p 48-53, Spring 1980. 8 Fig.

Descriptors: *Desalination processes, *Distillation, *Electrodialysis, *Flash freezing, *Ion exchange, *Reverse osmosis, Membrane processes, Flash distillation, Water purification, Freshwater, Saline water, Salinity, Brines, Desalination, Water sources.

As the Earth's freshwater supply continues to shrink on a per capita basis due to population growth and pollution, interest in the desalting of water grows. By the year 2000 the market for desalting in the U.S. is expected to be over 29 billion gallons per day. Distillation, freezing, reverse osmosis, and electrodialysis are currently used methods of desalting. Factors influencing the effectiveness of each process include plant location, energy and its availability, feedwater type, and available brine disposal methods. Freezing and distillation are the preferred methods for desalting water with a high salt concentration. Multi-stage flash distillation, which is commonly used, has a continuous cycle to make maximum use of energy but problems occur due to scaling and fouling. Three major steps are involved in desalting by freezing: partial freezing to form an ice-slurry, separation of ice crystals from brine, and melting the ice. Freezing cannot currently desalt large quantities on an economical basis. Electrodialysis uses a cell pair with different types of ion-selective membranes and a direct current to cause ion migration. In reverse osmosis, also a membrane desalting process, pressure is applied to the salt water side of a semipermeable membrane causing fresh water to flow through the membrane. All of the processes generate brine wastes that are disposed of in a variety of ways. (Seigler-IPA)
W80-04509

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

THE EFFECT OF WATER PRETREATMENT CHEMICALS ON THE PERFORMANCE AND DURABILITY OF REVERSE OSMOSIS MEMBRANES,
California Univ., Los Angeles. School of Engineering and Applied Science.
J. W. McCutchan, and J. Glater.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174311, Price codes: A05 in paper copy, A01 in microfiche. Final Report to, Office of Water Research and Technology, January 31, 1980. p 68, 26 Fig, 7 Tab, 45 Ref. OWRT R-0049 (No 7810), 14-30-0001-7810.

Descriptors: *Reverse osmosis, *Membrane processes, *Membranes, *Water treatment, Cellulose acetate type membranes, Polyamide type membranes, Water pretreatment chemicals, Ozone, Chlorine, Bromine, Iodine, Chlorine dioxide, Water flux, Salt rejection, *Membrane damage, *Chemicals, Hydrogen ion concentration.

The sensitivity of commercial reverse osmosis membranes has been studied in a variety of chemical environments. Membranes were supplied by five manufacturers representing three general types. These are cellulose acetate, thin film composite polyamide and homogeneous polyamide. Pretreatment chemicals consisted of halogens, ozone, and chlorine dioxide. Membrane exposure was conducted by soak tests in buffer solutions over a pH range of 3.0 to 8.6 and concentrations between 1.0 and 125 ppm. Assessment of membrane damage was carried out by performance testing in a flat plate laboratory reverse osmosis unit using 5000 ppm sodium chloride feed solution. Chemical attack on membrane polymer was indicated by an increase in water flux and a decrease in salt rejection. Cellulose acetate membranes were the most resistant to chemical attack. They responded only to ozone and were also hydrolized at low pH. Polyamide membranes were sensitive to ozone, halogens, and chlorine dioxide. They were also hydrolized but at low pH. The activity of all chemical agents tested was responsive to solution pH. This factor controls the distribution of halogen molecular and ionic species and consequently the rate and possibly the mechanism of membrane attack. Under conditions which maximize damage, the order of activity of chemicals under study were $O_3 > ClO_2 > Cl_2 > Br_2 > I_2$.
W80-04596

3B. Water Yield Improvement

WEATHER MODIFICATION: WINNERS AND LOSERS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Water Spectrum, Vol 12, No 2, p 28-39, Spring 1980. 10 Fig, 2 Tab.

Descriptors: *Weather modification, *Cloud seeding, *Precipitation(Atmospheric), Agroclimatology, Legal aspects, Political aspects, Rain, Water shortage, Weather patterns, Cost-benefit theory, Rainfall intensity, Environmental effects, Agricultural engineering.

Weather modification in the United States is surrounded by considerable scientific uncertainty and local controversy. In the past the major concern was 'can we do it' with the assumption that weather modification would be for mankind's good. Now, however, the socio-politico-economic-environmental aspects of weather modification are asserting themselves. In the 1960's, situations developed where some people believed that weather modification was hurting their real or perceived interests. Although there is little evidence the weather modification actually decreased rainfall in some areas or caused flooding in others, there was much publicity and much of the general public has become skeptical about the use of weather modification. Questions are voiced concerning the effect of increased snowfall in the mountains on elk herds, the long-term effect of silver iodide on the environment, and the actual economic value of weather modification. Scenarios developed to forecast economic values vary widely, bringing more doubt into the issue. Legally, weather modification operators in the United States are subject to the rules and procedures of tort law and it is likely that the absolute liability (risk-spreading) theory will apply although only about a dozen damage actions have been brought. Weather modification will have to proceed in a comprehensive framework involving everyone potentially affected. (Seigler-IPA)
W80-04508

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 3F.
W80-04667

3C. Use Of Water Of Impaired Quality

HYDROLOGIC FEASIBILITY OF UTILIZING PALMS FOR WATER MANAGEMENT IN SOUTHERN NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
R. O. Patt, and D. E. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170624, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1978. 26 p, 6 Fig, 5 Tab, 9 Ref. OWRT A-073-NEV(1), 14-31-0001-5029.

Descriptors: *Dates, *Water management(Applied), *Irrigation water, *Water table, Southwest U.S., Nevada, Arid lands, Crop production, Alkaline soils, Sewage effluents, Alfalfa, Climatology, Palms.

The feasibility of utilizing date and ornamental palms as a management tool for beneficial use of groundwater and waste water in water-short areas such as the southwestern United States was investigated. Three potential planting sites in southern Nevada, the Las Vegas, Pahrump, and Moapa Valleys, were studied. Local climatic conditions in these areas were determined to be suitable for palm propagation. Date culture requires long, hot summers, moderate winters, and low precipitation and humidity from July 1 to September 1, the rapid fruit growth period. Palms readily adapt to various soils and will endure saline soil once established. For the three sites studied the only limiting factors found appear to be the availability and source of water supply. The Las Vegas Valley appears to be the most favorable site studied since it is underlain by shallow groundwater, and irrigation from sewage effluent is available. The Las Vegas Valley would also be an ideal area to study hydrologic characteristics of the palm and water table conditions. Alfalfa is currently the main crop in the valley but problems are occurring due to the high water table and poor irrigation water quality. Date palms would be an economically feasible transition crop for the area and could help to stabilize the water table. (Seigler-IPA)
W80-04504

3D. Conservation In Domestic and Municipal Use

STATE AGENCY EFFORTS IN WATER CONSERVATION.
California State Dept. of Water Resources, Sacramento. Div. of Planning.
Memorandum Report, December 1978. 26 p, 3 Fig, 47 Ref, 4 Attachments.

Descriptors: *Water conservation, *Water consumption, *Water management(Applied), *Water policy, *California, Conservation, Water use, Water resources, Water shortage, Regulation, Water demand, Education.

This report examines a State of California program to implement water conservation measures for all state agencies. Sixty-two state agencies met to decide on how the program should be carried out, and all agreed to set up employee education programs, cut down their own direct water use, convey to the community the need and methods for water conservation, and to have regulatory agencies include water conservation in their regulations where possible. Methods of saving water within state agencies included making maximum use of reclaimed water where available, equipping state-owned dwelling units with water-saving shower and toilet devices, reducing 'open hours' for state park shower facilities, reducing water pressure, adopting emergency water conservation and protection measures for certain state managed watersheds, requiring water permittees and applicants to demonstrate evidence of water conservation action, and preparing draft regulations to prevent waste or unreasonable use of water. Some results of the program include the water conservation education of 129,000 state employees, exposure of 5 million citizens to water conservation publications, and the savings of 30,000 acre-feet of water in state facilities in 1977. (Arnold-NC)
W80-04747

A PILOT WATER CONSERVATION PROGRAM.
California Dept. of Water Resources, Sacramento. Bulletin 191, October 1978. 64 p, 20 Fig, 3 Tab, 8 Append.

Descriptors: *Water conservation, *Water saving devices, *Water law, *California, *Water use, *Water management(Applied), Water supply, Conservation, Water resources, Water shortage, Water demand, Education, Water pressure, Water control, Water distribution.

This is a report on a program undertaken after the 1976-77 drought to effect water conservation in homes by introducing water saving devices. The goals of the program were to find out if a significant amount of water and energy could be saved by installing water saving devices in dwellings; to determine which methods of distribution are most successful and cost effective; to evaluate relative merits of selling devices or offering them free, and which devices are most acceptable; and to determine the feasibility of distributing water saving devices throughout the state. Six areas were chosen for pilot projects. Number of households varied from 253 to 370,000, water supply conditions varied from no problem to heavy rationing, and home water conservation kit delivery varied from free door-to-door delivery to purchase upon request. In almost all areas, water savings in homes using the kits was significant, most residents had already heard of the program, and there was little or no correlation between income level and willingness to use the kit. Most people believed they were saving water, and overwhelming majorities in each area believed the devices they installed were working. Annual water savings ranged from 12.5 to 3000 acre feet for the various programs. Toilet dams were found to be the most popular tank devices, and the most successful in saving water. Short intensive distribution of devices was most effective; a telephone hotline was found to be essential for giving information on the program. School education programs proved to be important. Interagency cooperation allowed easier access to urban residents, particularly through use of members of the California Conservation Corps taking the water saving kits directly to the public. Devices should be supplied free of charge. (Arnold-NC)
W80-04749

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento. Bulletin No 198, May 1976. 95 p, 18 Fig, 29 Tab, 18 Ref, 2 Append.

Descriptors: *Water conservation, *Water policy, *Water law, *California, *Conservation, *Water demand, *Water use, Agriculture, Water resources, Water shortage, Water demand, Water delivery, Hydrologic areas, Regulation, Legal aspects.

This study outlines existing water conservation efforts in the private and public sectors of the economy of the State of California. Following a series of droughts in 1974, 1975, and 1976, the State Department of Water Resources found that water use indicated an 84.69% consumption by agriculture; 13.47% by urban uses; 0.10% for power plant cooling; and 1.74% for fish, wildlife, and recreation. Efforts to persuade the urban sector to save included publishing pamphlets on repair of faulty faucets and plumbing fixtures; reducing exterior residential water use such as lawn watering; installing water saving technology in newly built structures; and installing water-saving devices in existing structures. Examining the state's eleven hydrologic study areas revealed that water shortage problems were exacerbated by economic and development pressures, and thus appropriate land regulatory devices were proposed for those study areas. Possible water savings by the agricultural sector in the eleven study areas ranged 40,000 to 520,000 acre-feet. Major conservation practices in the areas included improved delivery and reuse systems, moratoria on further water extraction, and conjunctive surface-ground operations. For urban water conservation, DWR recommends that all new homes have low-flow device plumbing fixtures; institution of delivery system leak detection programs; and replacing current pricing systems favoring large users with uniform, peak/seasonal or increasing block rates, using the lifeline rate concept where appropriate. Agricultural water conservation measures are also recommended. (Arnold-NC)
W80-04750

3F. Conservation In Agriculture

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
K. E. Foster, and N. G. Wright.
Ground Water, Vol 18, No 1, p 31-36, January-February, 1980. 1 Fig, 6 Tab, 16 Ref.

Descriptors: *Arid lands, *Oilseed crops, *Ground water, *Water requirement, Irrigation water, Municipal water, Reasonable use, Water consumption, Overdraft, Arizona, Ground water mining, Water rights, Water law, Ground water basins, Economic feasibility, Acreage.

Municipal, agricultural, mineral and industrial ground water withdrawals from two basins in the Tucson area amount to 376,000 acre-feet per year (AFY) or 296,000 AFY more than the safe yield. About 80 percent of this overdraft is for irrigation agriculture. To insure adequate ground water supplies, the City of Tucson has been purchasing and retiring farmlands in one basin. This creates weed problems for farmers owning adjacent land. An alternative to retiring farmlands and heavy irrigation is to cultivate arid-adapted vegetation with economic potential such as Jojoba. It requires only 1.5 AFY per acre compared with traditional crops that average 4 AFY or more, but it needs 10 years of cultivating before it can produce economically feasible yield. If the City of Tucson subsidized farmers during this time at a rate of $40 per acre, it would save more than 50 percent of the cost to purchase and retire farmlands and still be able to draw water from the basin for municipal uses. However, implementing this plan would require changing Arizona ground water law to allow basin exports without the necessity of land aquisition. (Purdin-NWWA)
W80-04667

WATER, WASTE AND QUALITY MANAGEMENT DURING PREPARATION AND PROCESSING OF VEGETABLES,
Arkansas Water Resources Research Center, Fayetteville.
W. A. Sistrunk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176969, Price codes: A05 in paper copy, A01 in microfiche. AWRRC Publication No 65, August 1979. 107 p, 6 Fig, 72 Tab, 37 Ref, 4 Append. OWRT A-032-ARK(1).

Descriptors: *Vegetable crops, *Waste water(Pollution), *Consumptive use, Efficiencies, Water requirements, Potatoes, Beans, Crops, Fermentation, Sweet potatoes, Agriculture, Industrial wastes, Anaerobic condition, Biochemical oxygen demand, Water quality.

Effluent from vegetable processing plants in the Ozark region was monitored to test and develop new systems of washing, peeling and blanching; to develop methods for utilization of solid wastes; and to reduce effluent wastestrength without affecting vegetable quality. From a processing plants' survey the following operation or factors were found to be the most critical: (1) washing and cleaning, (2) blanching and cooling, (3) high wastestrength from Irish potatoes, dry beans, and

hominy processing, (4) suspended solids removal, and (5) excessive fresh water use. Various processing techniques were tested and waste water was sampled for biochemical oxygen demand, chemical oxygen demand, total suspended solids, settleable solids, and total solids. Vegetable processing methodologies tested included repetitive washing of spinach in the same water to cut down on consumption, steam blanching instead of water blanching, reduced soaking time for dry beans to reduce high wastestrength, and a new hominy preparation method to reduce pollution. The new system of leafy greens washing cut water use by 70% while reducing wastestrength by 50%. Extensive tables of results are given. Results from experiments of the storage and fermentation of high alkalinity wastes from Irish and sweet potatoes are also described. (Seigler-IPA)
W80-04671

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04750

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE NORTH MAROONDAH EXPERIMENT PRETREATMENT PHASE COMPARISON OF CATCHMENT WATER BALANCES,
Melbourne and Metropolitan Board of Works (Australia).
K. J. Langford, R. J. Moran, and P. J. O'Shaughnessy.
Journal of Hydrology, Vol 46, No 1/2, p 123-145, March 1980. 6 Fig, 6 Tab, 19 Ref.

Descriptors: *Australia, *Watersheds(Basins), *Water balance, *Vegetation regrowth, *Ash trees, Streamflow, Statistical methods, Regression analysis, Water supply, Forest management, Rainfall, Topography, Drainage density, Mountain ash, Basal area, Radiation index, Wetted area.

The North Maroondah Experimental Area contains a series of controlled catchment experiments which have the two major objectives of investigating the effects on long-term streamflow yields of reducing the density of existing 1939 regrowth mountain ash (Eucalyptus regnans), and controlling the density of planting or sowing at the time of establishment of new stands. The aims of the analysis described in this paper are to examine the relationships between catchment water balances and catchment characteristics for the pretreatment period, and to identify any atypical catchments. An intercatchment comparison of twelve regrowth catchments based on an analysis of covariance of annual streamflow and catchment loss (i.e., catchment rainfall minus streamflow) identified two catchments which are losing water, and one collecting water from outside its topographic boundaries. Further statistical analyses of data from the nine typical regrowth catchments detected significant relationships between average catchment loss, radiation index, and basal area of regrowth forest on the catchment. Catchment loss increased with both radiation index and basal area. The results indicated that if a thinned forest behaves in the same way as a natural forest with low basal area increases in streamflow resulting from thinning would be important from a water supply point of view. A comparison of the nine typical regrowth and two old growth catchments showed that the old growth catchments had significantly lower catchment loss. Further analysis showed that there was a significant relationship between annual catchment loss and stocking rate of trees for the eleven catchments. The decrease in streamflow which would result from conversion of an open old growth forest (20 trees/ha) to a dense regrowth forest (400 trees/ha) is of the order of 100-200 mm which is also important from a water supply point of view. (Visocky-ISWS)
W80-04512

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

EFFECTS OF WETLANDS ON WATER QUALITY IN THE DEVILS LAKE BASIN, NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
J. J. Peterka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175292, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University. Research Project Technical Completion Report, October 1979. p 17, 3 Fig, 1 Tab, 4 Ref. OWRT A-052-NDAK(1).

Descriptors: *North Dakota, *Wetlands, *Runoff, *Phosphorus, *Nitrogen, Drainage water, Watersheds(Basins), Agricultural runoff, Nutrients, Water quality, Dissolved solids, Soil properties, Surface runoff, Grassed waterways, Watershed management.

Contributions of dissolved and particulate substances to the runoff from drained wetlands and agricultural lands were studied in the Starkweather Watershed of the Devils Lake Basin, North Dakota. The Starkweather coulee is the major drainage for the 997 sq km Starkweather Watershed. While various sites were used the primary site chosen for sampling was in a 0.50 ha Type IV wetland that normally contains water throughout the year. Although measurements were taken from 1976 through 1979, weather conditions such as drought made runoff sampling difficult. Various factors assessed include: changes in concentrations of substances in runoff with time following drainage, changes in soil nitrogen and phosphorus with time following drainage, trends in concentrations of dissolved and particulate substances both upstream and downstream, and measurements of major anions, cations, seston, conductivity, and pH. Only the results for phosphorus and nitrogen are given; other results are given by De Groot (1979). Results show that the greatest release of nitrogen and phosphorus from drained wetland basins occurs in about the first four years after drainage. High levels of nitrogen in runoff waters from areas of intensive agricultural practice were found in contrast to low levels of nitrogen in grassland runoff areas. These results support the theory that once perennial vegetation is established in a drained wetland only small losses of nitrogen occur unless excessive grazing is permitted. (Seigler-IPA)
W80-04607

NUTRITIONAL COMPOSITION OF WATER HYACINTHS GROWN ON DOMESTIC SEWAGE,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Economic Botany, Vol 32, No 4, p 363-370, October-December 1978. 1 Fig, 9 Tab, 24 Ref.

Descriptors: *Aquatic weed control, *Water hyacinth, *Waste water disposal, *Beneficial use, Aquatic weeds, Nutrients, Eichornia crassipes, Proteins, Feeds, Feed lots, Adsorption, Absorption, Foods, Plant tissues, Fibers(Plant), Waste water treatment.

A nutrient analysis of water hyacinths grown in sewage wastewater was conducted. Plants (Eichornia crassipes) from different sampling locations were found to contain fairly constant amounts of fat, fiber, and ash. However, phosphorus content and crude protein varied considerably among the sampling sites. Direct correlation was found between nutrient loading rate and crude protein content of the water hyacinths. At the highest nutrient loading rates, the difference in percent crude protein was less pronounced, indicating that plant protein reached a maximum level. Most of the phosphorus (66%) was concentrated in the leaves and stems. Other plant constituents also showed some partitioning within the plant tissue. For example, leaves contained the highest percentage of crude protein and the lowest percentage of ash. The stems contained the largest portion of plant fiber. The amino acids content of water hyacinth leaves compares favorably with that of soybean and cottonseed meal. Mineral and vitamin concentrations also showed partitioning within various plant tissues. Iron, copper, and sulfur were concentrated in the roots, while magnesium was concentrated in the leaves. No toxic levels of lead, silver, cadmium, or chromium were detected in the leaf tissue. The roots contained over 50 times the amount of vitamin B12 present in the leaves. Water hyacinth could be an excellent source of proteins, vitamins, and minerals, and could be of particular value as a dietary supplement in countries where human diets are deficient in these nutrients. (Harris-Wisconsin)
W80-04660

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
June 1978. 40 p, 16 Fig, 10 Tab.

Descriptors: *Water supply, *Water quality, *Water resources, *Water use, *Florida, *Planning, *Water management(Applied), Water demand, Water development, Administration, Wastewater reuse, Irrigation, Demineralization, Salinity, Aquifers, Water storage, Water conservation.

This plan was prepared by the South Florida Water Management District (SFWMD), an agency having water quality and quantity management responsibility for 14 southernmost Florida counties. Largely a flat area with subtropical vegetation and sawgrass, the SFWMD experiences its driest months from November through May, with water supply lowest during February. Major water uses are municipal, agricultural irrigation, Everglades National Park use, self-supplied industrial, power development, and salinity control. Consideration is given to the multiobjective approach to water resources management, whereby water supply must be managed so as to meet adequately the needs of economic development, environmental protection, drainage, flood control, and water storage. Recommendations for district water management include: encouraging better water conservation through practice and public education; supporting the development of wellfields and backpumping of the lower East Coast canals; implementation of regional demineralization facilities; deep acquifer storage and increased storage in Lake Okeechobee; wastewater reuse through support of local government and utility efforts; and support of U.S. Corps of Engineers study on wastewater reuse as an alternative water supply source. The rationale for each recommendation is presented, along with specific concerns, implementation and local action. (Arnold-NC)
W80-04746

ANALYSIS OF STRUCTURAL AND NONSTRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W80-04772

EMERGING TRENDS IN THE USE OF INTERNATIONAL LAW AND INSTITUTIONS FOR THE MANAGEMENT OF INTERNATIONAL WATER RESOURCES,
Denver Univ., CO.
For primary bibliographic entry see Field 6E.
W80-04787

ONCE-RELEASED IRRIGATION WATERS: LIABILITY AND LITIGATION,
For primary bibliographic entry see Field 6E.
W80-04789

4B. Groundwater Management

THE LONG ISLAND EXPERIENCE WITH WATER RETENTION AND RECHARGE MANAGEMENT,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Aronson.
In: Managing the Demand for Recreation and Tourism: Proceedings of workshop held in Ocean City, Maryland, September 27-29, 1978. Co-sponsored by the Cooperative Extension Services of Delaware, Maryland, New Jersey and Virginia, p 48-51, 1978. 12 Ref.

Descriptors: *Groundwater recharge, *Retention, *Artificial recharge, *Reclaimed water, *Water supply, Water storage, Water table, Storm runoff, Watersheds(Basins), Controlled drainage, Infiltration, Recreation, New York, *Long Island(NY).

Ground water is the sole source of freshwater for the residents of Nassau and Suffolk Counties on Long Island, N. Y. The ground-water reservoir is recharged only by local precipitation seeping from the land surface to the water table. Rapid urbanization of Nassau County caused a reduction of natural recharge as storm runoff from paved surfaces was carried to coastal waters through storm sewers. In 1935, Nassau County began to construct large basins to impound storm water and to return it to the ground-water reservoir by infiltration through underlying deposits. The use of storm-water basins not only helps to conserve storm runoff and to augment the freshwater reservoir, but it also has eliminated the need for long, costly trunk storm sewers to carry storm runoff to tidewater. Storm-water basins on Long Island are open pits excavated in permeable sand and gravel deposits of glacial origin. Basins dispose mostly of storm runoff from residential, industrial, and commercial areas and from highways. At present (1978), more than 2,500 storm-water basins are in operation in Nassau and Suffolk Counties. (Kosco-USGS)
W80-04545

AQUIFERS IN WALWORTH COUNTY, SOUTH DAKOTA,
Geological Survey, Garden City, KS. Water Resources Div.
J. Kume.
South Dakota Geological Survey Information Pamphlet No 18, 1979. 4 p, 3 Fig.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *South Dakota, Water yield, Water wells, Pumping, Water utilization, Aquifer systems, Walworth County(S Dak).

The water in four glacial-outwash sand and gravel aquifers in Walworth County, South Dakota, generally is of suitable quality for domestic, stock, municipal, and irrigation use. The Grand aquifer underlies about 106 square miles, averages 39 feet in thickness, and may yield as much as 600 gallons per minute to a pumping well. Three smaller aquifers composed of glacial-outwash sand and gravel, yield from 30 to 400 gallons per minute to individual wells. The Java sand and gravel aquifer consists of glacial outwash and preglacial stream sediment. The aquifer underlies about 100 square miles, averages 22 feet in thickness, and may yield as much as 50 gallons per minute to a pumping well. The Dakota and Fall River sandstone aquifers are the major bedrock aquifers that underlie the area. The Dakota aquifer is about 130 feet thick at an average depth of 1,940 feet. Its water is of the sodium chloride type. The Fall River aquifer ranges in thickness from about 140 to 200 feet at an average depth of 2,100 feet. Its water is of the calcium sulfate type. Water from these bedrock aquifers is used for domestic and stock purposes, but is too highly mineralized to be suitable for irrigation. (Kosco-USGS)
W80-04555

HYDROGEOCHEMICAL PROCESSES AFFECTING THE MIGRATION OF RADIONUCLIDES IN A FLUVIAL SAND AQUIFER AT THE CHALK RIVER NUCLEAR LABORATORIES,
National Hydrology Research Omst/. Ottawa (Ontario).
R. E. Jackson, and K. J. Inch.
NHRI Paper No 7, Scientific Series No 104, 1980. 58 p, 33 Fig, 25 Tab, 85 Ref, 1 App.

Descriptors: *Hydrogeochemical controls, *Radionuclides, *Groundwaters, *Aquifers, *Sediments, *Radioactive wastes, *Minerals, Migration, Adsorption, Treatment processes, Radioactivity.

In the mid-1950s, two experimental disposals of liquid radioactive waste containing approximately 700 curies (Ci) of 90Sr and 137Cs were made into shallow pits dug into the sandy ground of one of the disposal areas at the Chalk River Nuclear Laboratories (CRNL). The disposal area is part of the recharge area of a shallow groundwater flow system of approximately 1 km in length containing two aquifers-the Middle and Lower Sands units. In the past 25 years, the radioactive wastes have migrated into both aquifers and have chromatographically separated into 90Sr and 137Cs plumes. These plumes are moving at characteristic velocities much less than the velocity of the transporting groundwater. For 90Sr, this characteristic velocity is 3% of that of groundwater; for 137Cs, it is about 0.3%. The objectives of this study are (1) to investigate the hydrogeochemical controls on the migration of sampling, preservation and analysis of contaminated groundwaters and aquifer sediments. For studies of groundwater quality or pollution it is concluded that EH measurements should be complemented with measurements of dissolved oxygen and sulphide, since these can give an independent assessment of the redox level of a groundwater. Three distinct redox zones seem to exist in the groundwater flow system-oxygen, iron manganese and sulphide. The mobility of multivalent transition metals and nonmetals varies in these zones. (WATDOC)
W80-04567

REFLECTIONS ON GROUND WATER MANAGEMENT,
California State Water Resources Control Board, Sacramento.
W. D. Maughan.
Irrigation Journal, Vol 30, No 1, p 50, January-February, 1980.

Descriptors: *Ground water, *Water management(Applied), Overdraft, Arid lands, Ground water mining, Local governments, Imported water, Adjudication procedure, Water rights.

Lack of ground water management in many basins has led to water level decline and the threat of overdraft, subsidence, water quality deterioration and loss of wells and aquifers. In some basins this trend has been reversed by the establishment of a local ground water management program. In other basin, local capabilities are inadequate to recover from overdraft and the only solutions are adjudication of water rights or intentional mining. For large basins, importation is thought to be the best solution but may take years to implement due to entangling litigation, interstate negotiations, and construction. It is practicable for private, local, and state roles in ground water management to be worked out satisfactorily, provided new concepts and principles are jointly developed. A formula should be developed and used within the next three to five years, if real serious consequences are to be avoided. (Purdin-NWWA)
W80-04762

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
J. H. Patric.
Journal of Environmental Quality, Vol 9, No 1, p 73-80, January-March 1980. 4 Fig, 10 Tab, 31 Ref.

Descriptors: *Forests, *Forest watersheds, *Clear-cutting, *Appalachian Mountain region, *West Virginia, Erosion, Water quality, Runoff, Watersheds(Basins), Forest management, Effects, Sediments, Suspended solids, Dissolved solids, Water temperature, Streamflow, Reforestation, Vegetation regrowth, Forestry, Hydrology.

The effects of silvicultural treatments on streamflow have been evaluated for 20 years on a 34.7-ha forested catchment on the Fernow Experimental Forest, near Parsons, in north-central West Virginia. Selection harvest of 13, 8, and 6% of the basal area in 1958, 1963, and 1968, respectively, had negligible effect on any measured property of water. In 1969-1970, 31.7 ha were harvested by clear-cutting, leaving a 3.0-ha protective strip of lightly cut forest extending about 20 m along both sides of the stream channel. This treatment had no effect on stormflow or stream temperature, but water yield increased 253 mm (38%) during the first year after cutting. Concentrations of sediment, nitrate, calcium, magnesium, potassium, and sodium in streamflow increased slightly. These effects on water quality were held to low levels by the protective strip and prudent management of logging roads. Subsequent cutting of the protective strip and clearing the stream channel in 1972 increased water yield 40 mm (9%) and raised stream temperature as much as 7.8C. Luxuriant regrowth over the entire watershed reduced all effects on water within 2 years after each treatment, and no effect from any treatment was measurable after 1977. (Sims-ISWS)
W80-04519

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

WATER BASED RECREATIONAL DEVELOPMENTS IN MICHIGAN - PROBLEMS OF DEVELOPERS,
Wayne State Univ., Detroit, MI.
For primary bibliographic entry see Field 6E.
W80-04591

URBAN HYDROLOGY IN KARST AND WATER QUALITY--INORGANIC AND ORGANIC SYSTEMS,
Indiana Univ. at Bloomington. Water Resources Research Center.
R. V. Ruhe, D. W. Clark, and M. L. Epstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174303, Price codes: A07 in paper copy, A01 in microfiche. Report of Investigations No 9, March 1980. p 139, 28 Fig, 23 Tab, 27 Ref, 2 Append. OWRT-C-7681 (No 7256)(3), 14-34-0001-7256.

Descriptors: *Storm runoff, *Water quality, *Urbanization, *Karst, Rainfall, Runoff, Flow duration, Response time, Impervious cover, *Inorganic components, Dissolved load, Particulates, *Organic compounds, Modeling, Urban hydrology, *Pollutants, *Bloomington, Indiana, *Volatile compounds, *Non-volatile compounds, Paraffinic acids, Pesticides, Polychlorinated biphenyls.

Storm runoff and water quality were studied in ten watersheds with little to increasingly greater urbanization in karst terrain in the Bloomington, Indiana area. Among rainfall, storm runoff, flow duration, and response time, total storm flow relates best to, and directly to total rainfall. This effect increases as impervious cover increases among the watersheds whose characteristics include size, cover, slope, drainage lengths, and density. Storm peak discharge increases as size increases. Duration of storm runoff and response time decrease as impervious cover increases. Karst complicates the system. Storm runoff in one watershed is transferred underground and causes delayed high stream flow in another watershed. Some inorganic components in the dissolved load decrease with increased storm discharge but others increase as particulates increase. Effluent from the

sanitary waste facility and runoff from streets and parking areas cause concentrations above normal of some components in dissolved and particulate loads in receiving waters. Storm runoff contains many volatile organic compounds and paraffinic oils, polycyclic aromatic hydrocarbons, fatty acids, pesticides, and polychlorinated biphenyls among non-volatile compounds. During storm runoff, patterns of concentrations of inorganic and organic compounds in hydrographs are very complex. Generalizations lead to over-simplification and perhaps meaningless modeling.
W80-04597

LIMNOLOGICAL STUDIES IN MONTANA: HYALITE RESERVOIR AND RESPONSES OF LOTIC PERIPHYTON TO DEEP-WATER DISCHARGES, GRAZING AND LOGGING,
Montana State Univ., Bozeman. Dept. of Microbiology.
M. D. Marcus, J. E. Schillinger, and D. G. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176134, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center. Montana State University, Publication No 92, August 1978. 156 p, 28 Fig, 23 Tab, 121 Ref, 2 Append. OWRT C-7054 (No 6207)(2), 14-34-0001-6207.

Descriptors: *Aquatic environment, *Biological communities, *Limnology, *Environment effects, Pollutant identification, Water quality, Reservoirs, Surface waters, Diatoms, Periphyton, Chlorophyll, *Montana, Hyalite Reservoir(Mont), Hyalite Creek(Mont), Bozeman Creek(Mont), Southcentral Montana, Deep-water discharge, Logging activities, Cattle grazing, Aphanizomenon flos-aquae.

Physical, biological and chemical parameters were studied at three sites from May 18 to October 16, 1976, to develop limnological data for Hyalite Reservoir in Southcentral Montana. Physio-chemical parameters and periphyton dynamics were investigated at a number of sites on three creeks in the vicinity of Bozeman, Montana, to evaluate impacts on water quality from (1) deep-water discharges, (2) logging activities, and (3) cattle grazing. Nutrient concentrations were greatest near the reservoir outlet and were strongly influenced by wind action and the deep-water discharge. Highest chlorophyll-a concentrations and primary production occurred nearest the dam. An Aphanizomenon flos-aquae bloom in the reservoir appeared to result from low nitrogen and carbon dioxide concentrations. Primary production in the reservoir and at stream sites was also nitrogen limited. Reservoir discharges releasing nitrogen stimulated periphytic productivity, improved the physiological condition of the primary producers and increased diatom species diversity. Logging activities had no apparent impact on periphyton; cattle grazing increased periphytic productivity and decreased diatom diversity. Toxins released from old growths on diatomers and low water temperatures appear to inhibit periphyton growth. (Hunt-Mont)
W80-04670

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
For primary bibliographic entry see Field 6D.
W80-04755

4D. Watershed Protection

PLANTING WHEEL TRAFFIC EFFECTS ON INTERROW RUNOFF AND INFILTRATION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 2G.
W80-04641

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
For primary bibliographic entry see Field 6E.
W80-04791

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TRIFLURALIN MOVEMENT IN RUNOFF FROM A SMALL AGRICULTURAL WATERSHED,
Science and Education Administration, Tifton, GA.
For primary bibliographic entry see Field 5B.
W80-04518

PERSISTENCE OF FLURIDONE IN SMALL PONDS,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
For primary bibliographic entry see Field 5B.
W80-04524

STORM WATER MANAGEMENT MODEL VERIFICATION - HAMILTON TEST CATCHMENT.
Gore and Storrie Ltd, Toronto (Ontario).
Environmental Protection Service, Ottawa, Ontario, Training and Technology Transfer Division (Water). Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 99, 1980. 92 p, 31 Fig, 11 Tab, 12 Ref. 74-8-6.

Descriptors: *Water quality, *Watershed topography, *Rainfall rate, *Runoff quality, *Pollutants, Data collections, Quality simulation models, Sewer systems, Hydrographs, Great Lakes, Ontario, Canada.

A residential test catchment in Hamilton, Ontario, was selected and equipped with a data acquisition system for the collection of rainfall data, and quantity and quality urban runoff data. The test catchment was served by a combined sewer system and comprised an area of 71 ha (176 acres). The hydrologic and physical characteristics of the watershed, the criteria adopted for the selection of the instrumentation system, its installation and the data collection procedure used are described. The results of data analysis and the calibration and verification results of the U.S. Environmental Protection Agency's Storm Water Management Model (SWMM) are discussed in detail and are presented in tabular and graphical forms. These results confirmed the reliable performance of the SWMM runoff quantity model as indicated by the reasonable agreement of the simulated hydrographs with observed values. On the other hand, the quality model used did not produce acceptable correlation between measured and simulated pollutographs when calibration was attempted on an event basis for some pollution parameters. (WATDOC)
W80-04566

URBAN HYDROLOGY IN KARST AND WATER QUALITY--INORGANIC AND ORGANIC SYSTEMS,
Indiana Univ. at Bloomington. Water Resources Research Center.
For primary bibliographic entry see Field 4C.
W80-04597

ANALYSIS OF RIVERS AND STREAMS OF SOUTHERN MISSOURI FOR EPA PRIORITY POLLUTANTS USING LIQUID CHROMATOGRAPHY,
Missouri Univ.-Rolla.
J. O. Stoffer, and C. M. Ratkey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173560, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Missouri, Completion Report, March 1980. p 30, 6 Fig, 4 Tab, 10 Ref. OWRT A-104-MO(1), 14-34-0001, 8027, 9027.

Descriptors: *Water analysis, *Pollutants, *Organic compounds, *Waste water(Pollution), Watersheds(Basins), Missouri, Southern Missouri, Analytical techniques, Benzene, Carbon tetrachloride, Chloroform, Vinyl chloride, Bromoform, Pentachlorophenol, P-dichlorobenzene, PCB, 1, 1, 2-trichloroethylene, Organic pesticides, 3, 4-benzpyrene, Atrazine, Roundup, Lasso, Sencor, Paraquat.

The authors compare two methods of trace enrichment of organic pollutants likely to be found in rivers, streams and wastewater of Southern Missouri. Recovery data indicates sub parts per billion concentration levels are detectable with one method while a 15 minute on site enrichment at the sub parts per million level is possible with the other method. Various means of identification along with their lower concentration limits are also discussed. Among these identification methods discussed are GC/MS/DS, conventional U.V. analysis, rapid scan U.V. spectrophotometry, and high pressure liquid chromatography with data handling capabilities. The results of analysis of river water samples showed remarkably clean conditions prevail in the remote southern Missouri streams. Compounds tentatively identified include phthalates, phenols, branched hydrocarbons, and chlorinated hydrocarbons along with other more complex compounds. Variations in liquid chromatograms using the two different methods were noted. These variations can be attributed to differences in the work-up procedure and to the amount of sediment present in the water sample. Overall reproducabilities for the two methods are tabulated and show consistent recoveries with linear response to change in concentration.
W80-04598

MEASUREMENT OF PHYTOPLANKTON GROWTH BY PARTICLE COUNTING,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
R. W. Sheldon.
Limnology and Oceanography, Vol 24, No 4, p 760-767, July 1979. 9 Fig, 14 Ref.

Descriptors: *Phytoplankton, *Measurement, *Particle size, *Growth rates, *Detritus, Size, Equations, Estimating, Estimating equations, Mathematical studies, Biomass, Curves, Methodology, Analytical techniques, Diurnal, Microscopy, Sampling, Organic matter, Diatoms.

Phytoplankton growth rates can be measured in natural waters by particle counting, but experimental procedures are not routine. Each experiment has to be carefully planned and diurnal growth variations must be recognized. Asymptotic approximations cannot be used. Attention should be given to several points: (1) Growing material must be identified either with microscopes or by chemical determinations. (2) The size range over which growth occurs is identified on a size spectrum. Over a restricted size range phytoplankton grows essentially free of detritus, exhibiting an exponential growth pattern. (3) Experimental error must be minimized. Sample variation is reduced when all samples are taken from one large bottle. Large counts minimize counting errors. (4) Enough samples must be taken to define growth patterns; different experiments must take place. A preliminary run determines what is growing and the size range. In a second experiment, diurnal growth variations are established. Finally, a third experiment checks long-term growth patterns. Methods described by Cushing and Nicholson have produced obvious anomalies in past experiments due to the mathematical form of growth relationships. In phytoplankton growth studies in Bedford Basin, Nova Scotia, particle counting of a diatom bloom measured 15 March 1976, indicated that particulate matter was 99% detritus and 1% phytoplankton. Those growth constants best fit an asymptotic function. This shows that in practical terms, estimating phytoplankton growth by particle counting is not possible either by curve fitting or by Cushing and Nicholson methods. (Danovich-Wisconsin)
W80-04648

QUANTIFICATION OF NON-POINT WATER POLLUTANTS FROM LOGGING, CATTLE GRAZING, MINING, AND SUBDIVISION ACTIVITIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
J. E. Schillinger, and D. G. Stuart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-174063, Price codes: A16 in paper copy, A01 in microfiche. Montana Water Resources Research Center. Montana State University Report No 93, 1978. 366 p, 97 Fig, 59 Tab, 319 Ref, 2 Append. OWRT-C-7054 (No 6207)(1), 14-34-0001-6207.

Descriptors: *Water quality, *Watersheds(Basins), Streamflow, Monitoring, *Water pollution sources, Stream pollution, Water chemistry, Bioindicators, Sediment, *Grazing, *Mining, *Logging(Lumber), *Urban runoff, Suburban areas, Geology, Storm runoff, Snowmelt, Elevation, Gradient(Stream), *Land use, Temperature, Conductivity, Turbidity, Alkalinity, Ammonia, Calcium, Chlorides, Magnesium, Nitrates, Nitrites, Potassium, Sodium, Sulfates, Bozeman Creek, Hyalite Creek, Gallatin County, Montana, Non-point source, Cattle grazing index, Clearcutting, Fecal coliforms, Fecal streptococci, Orthophosphate, Standard plate count, Enterobacter, Klebsiella, Leptospiria, Multiple regression, Factor analysis.

Water quality data were collected over a two-year period in at 57 points in the Hyalite Creek and Bozeman Creek watersheds in southwestern Montana to determine the contribution of different activities to changes in the water chemistry, suspended sediment levels, and bacterial indicator count in streamflow. Cattle grazing increased fecal coliform; a cattle grazing index is formulated and correlated with the fecal coliform concentration and is shown as a function of a grazing management rating to relate a cattle management system to water quality. Clearcut logging did not significantly effect water quality. Although soil erosion occurred in clearcut areas, little sediment reached the streams from disturbances more than 30m away. Stormwater runoff, septic tank drainfields and construction in subdivisions in urban and suburban areas significantly altered the bacteriological and chemical quality and amount of suspended sediment in stream. Effects of groundwater seeping through a lead mine operated intermittently adjacent (300m) to stream were insignificant on water quality. A factor analysis indicates natural processes (1) correlate significantly with changes in water quality in high mountain streams than logging and grazing, and (2) do not correlate significantly in urban and suburban developments. Bacteriological analysis indicates Klebsiella and Enterobacter may indicate pollution from storm sewers and septic tanks better than total coliform. Methods for in situ and in vitro examination of leptrospires are presented.
W80-04669

OXYGEN CONTENT AND TOXICITY FOR FISH OF SOME SUBSTANCES IN HEATED WATERS,
Institute of Meteorology and Water Management, Warsaw (Poland). Dept. of Water Economics.
M. Gadkowski, A. Lysak, and B. Kokurewicz.
Polish Ecological Studies, Vol 5, No 3, p 18-23, 1979. 1 Tab.

Descriptors: *Toxicity, Water pollution effects, *Phenol, *Zinc, *Copper, *Cadmium, *Mercury, *Water temperature, Cooling water, Electric power production, Electric power plants, Poland, Freshwater fish.

The heating of river waters by an electric power plant do not deteriorate the oxygen balance of the river. The effect of increased water temperature on the toxicity of phenols, zinc, copper, cadmium, mercury as indicated by the literature is inconclusive and not consistent. It is suggested that long term studies be conducted to determine the long range effects of toxicants on fish in heated waters. (Katz-EIS)
W80-04681

LETHAL TEMPERATURES FOR FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 24-32, 1979. 7 Fig.

Descriptors: *Water pollution effects, *Water temperature, Electric power plants, Freshwater fish, *Poland, *Vistula River(Poland), *Atlantic salmon, *Lethal temperatures, Bass, Pike, Perch, Acclimation, Temperatures, Catfish, Carp, Cyprinids.

Comparison of lethal temperatures for fish occurring in the mid- and low course of the Vistula River with predicted temperatures after heating of these sections leads to the hopeful conclusion that even maximal predicted temperatures will not be the immediate cause of mortality of fish moving freely in the heated environment. Mortality can take place in the case of sudden occurrence of extreme temperatures exceeding 34C, or in the case of carrying fry and juveniles by the current from unheated sections of the river. Stream-like discharge of warm water that is maintaining an unheated current along one of the banks is of basic significance for survival of the most valuable fish populations in our waters - migrating salmonid fish species - the Atlantic salmon, Salmo salar L. and the sea-trout, S. trutta L. (Katz-EIS)
W80-04682

FISH METABOLISM,
Institute of Applied Biology, Siedlce (Poland).
B. Jezierska.
Polish Ecological Studies, Vol 5, No 3, p 43-51, 1979. 6 Fig.

Descriptors: *Fish physiology, *Fish behavior, *Water temperature, *Vistula River(Poland), *Poland, Metabolism, Water pollution effects, Cooling water, *Thermal effluents, Salmon, Cold water fish, Warm water fish, Fresh water fish, Brown trout, Catfish, Dissolved oxygen, Critical oxygen content.

Heating of the aquatic environment results in an increase of the rate of metabolism in fishes, this being related to increased activity and higher rate of basic physiological processes. Rate of standard metabolism can become even twice higher in conditions predicted by the model of the effects of heated effluents on water temperatures in the Vistula River. When the temperatures exceed 28-30C and oxygen content falls below 6 mg/l, some disorders in metabolic processes may occur, such as decrease of gas exchange rate, 'anaerobic respiration', and their consequences for the organism. Changes of the temperature and of the oxygen content which do not exceed the above range usually result in an adaptation to the heated environment of most freshwater fish species of interest to this study. The longer the period of altered environment the more thorough is adaptation of fish to the conditions, although the character of adaptive changes affects also fish organism as such. This may result in a development of a new 'variety' of fish adapted to new environmental conditions. (Katz-EIS)
W80-04684

FEEDING OF FISH AND THEIR FEEDING GROUNDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
T. Backiel.
Polish Ecological Studies, Vol 5, No 3, p 72-79, 1979. 4 Fig.

Descriptors: *Fish physiology, *Fish diets, *Vistula River(Poland), Poland, Cooling water, *Thermal effluent, Aquiculture, Benthos, Sediments, Zooplankton, Channel morphology, Channel improvement, Backwater, Backwater areas, Fresh water fish, Water temperature, Warm water fish.

Material carried by the water (drift) will be reduced in proportion to the amount of water taken by the power plant. Thus, for example, the average water intake by the Kozienice electric power plant is only around 6.4% of the average flow and it can be expected that less than 6% of the live components drifted is destroyed. At low water levels and maximal output of the power plant this effect may be around 2.5 times higher, but even then the influence of the plant on this ground is only slight. Due to narrowing of the river bed and due to embankments in the region of any power plant and, consequently, acceleration of the current, the number of feeding grounds developing on a hard river bottom will increase. Such feeding grounds within the range of a warm water stream will become more abundant. Feeding grounds of silted, muddy bottom within the range of a warm water stream may become poorer. The influence of such a warm water stream on closed backwater areas, if any are left (see below), is significant. It is difficult to predict the changes in zooplankton, but one can assume that the benthos will undergo unfavourable changes, while vegetation and its accompanying fauna will show exhuberant development. About twofold increase of food requirements may not be met with by fish feeding on the muddy bottom, but will most likely be satisfied by fish grazing on fauna which develops on hard objects in the river channel. (Katz-EIS)
W80-04687

THE IMPACT ON ICHTHYOFAUNA AND POSSIBLE CONTROL OF THE EFFECTS OF THERMAL DISCHARGE,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
T. Backiel, M. Gadkowski, and L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 100-107, 1979. 1 Fig, 2 Tab.

Descriptors: *Water pollution effects, *Aquiculture, *Vistula River(Poland), *Poland, Water temperature, Monitoring, *Fish population, Thermal powerplants, Growth, Fish reproduction, Fish diets, Fish behavior, Fish physiology.

The series of papers are briefly synthesized under two main groups: (1) The predicted changes in the river environment affected by the power plant and (2) the predicted changes and the possible deleterious effects in the fish population resulting from the effects of the power plant on the river environment. Also discussed are the adaptation of fish to heated waters, the acceptable variations in water temperature and the maximum tolerated temperatures, the distribution of water temperature in the Vistula River and the changes in the river bed. The possibilities of reducing the adverse effects of heated effluents, the monitoring of fish population and the use of the effluents in fish farming. (Katz-EIS)
W80-04691

TISSUE METAL CONCENTRATIONS IN TWO CRAYFISH SPECIES COHABITING A TENNESSEE CAVE STREAM,
Savannah River Ecology Lab., Aiken, SC.
G. W. Dickson, L. A. Briese, and J. P. Giesy, Jr.
Oecologia, Vol 44, p 8-12, 1979. 1 Fig, 3 Tab, 32 Ref.

Descriptors: *Metals, *Crayfish, *Absorption, *Cadmium, *Chromium, *Copper, *Iron, Magnesium, Manganese, *Lead, *Zinc, Calcium, Potassium, Toxicity, Mortality, Animal behavior, Fecundity, Life History Studies, *Tissue analysis, *Bioaccumulation, Tennessee, White County(Tenn).

Concentrations of Cd, Cr, Cu, Fe, Mg, Mn, Pb, Zn, Ca and K were examined in tissues of the troglobitic (obligatory cave-dwelling) crayfish Orconectes australis australis and troglophilic (facultative cave-dwelling) species Cambarus tenebrosus. These two species cohabit a stream in Merrybranch Cave, located in rural White Co., Tennessee. Tissue concentrations of essential metals did not exhibit any trends between species. In contrast, Cd and Pb concentrations were found to be significantly greater in O. australis for almost all of the tissues analyzed. The higher Cd and Pb concentrations in O. australis are thought to be due to the increased longevity of this troglobitic species. Because of the toxicity of Cd and Pb, chronic exposure to relatively low concentrations of these

metals could cause changes in mortality, fecundity or behaviour in aquatic organisms possessing long life spans. The bioaccumulation of metals from low level, non-point sources is discussed in relation to life history strategies. (Deal-EIS)
W80-04696

TOXICITY OF BUTOXYETHYL ESTER OF 2,4-D TO SELECTED SALMON AND TROUT,
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).
D. W. Martens, R. W. Gordon, and J. A. Servizi.
Progress Report No 40, 1980. 18 p, 1 Fig, 5 Tab, 13 Ref.

Descriptors: *2,4-D, *Bioassay, *Salmonids, *Toxicity, Sockeye salmon, Pink salmon, Rainbow trout, Fry, Growth stages, Pesticide toxicity, Lethal limit, Mortality, Chemical properties, Pesticide kinetics, Microbial degradation, *Aqua-Kleen.

Sockeye, coho and pink salmon and rainbow trout were exposed to butoxyethyl ester of 2,4-D (BEE) derived from Aqua-Kleen 20 in semi-static acute and chronic bioassays. The 96 hr LC50 was approximately 0.45 mg/l BEE for sockeye fingerlings, coho fry and pink fry. Rainbow trout were slightly more sensitive to BEE than the salmon tested. Sockeye smolts and pink salmon fry survived transfer to seawater after 24 hour exposure to concentrations of BEE nearly equal to the 96 hr LC50. Pink and coho salmon and rainbow trout were shorter than control specimens at yolk absorption following exposure to 0.220 mg/l BEE during the alevin stage. No mortality or distress was observed among sockeye fingerlings exposed to 200 mg/l 2,4-D acid for 168 hours. The influences of bacterial activity, temperature and pH on bydrolysis of BEE to 2,4-D acid are discussed. (Deal-EIS)
W80-04700

PRODUCTION, MORTALITY, AND POWER PLANT ENTRAINMENT OF LARVAL YELLOW PERCH IN WESTERN LAKE ERIE,
Environmental Research Lab. Duluth, MN.
R. L. Patterson.
Report EPA-600/3-79-087, 1979. 199 p, 45 Fig, 40 Tab, 7 App, 23 Ref.

Descriptors: *Powerplants, *Entrainment, *Yellow perch, *Mortality, *Lake Erie, Growth stages, Larval growth stage, Perches, Fish populations, Fish management, Mathematical models, Monroe Power Plant(Mich), *Impingement.

This study assessed impacts of the Monroe Power Plant upon the yellow perch population of Western Lake Erie caused by entrainment and impingement of larvae and older fishes in the plant's open cycle cooling system in 1975-76. Estimates of total numbers of perch larvae entrained, total perch production, the natural mortality rate of perch, and the percentage of perch production that was entrained by the Monroe Power Plant were obtained for 1975-76. Impingement estimates were obtained from data supplied by the power plant. The above estimates consider only effects that occur in the same year in which entrainment and impingement occurs. Impacts may occur in subsequent years which include a depression of fish stocks and reduced yields to the fishery. Losses to the standing stocks and fisheries were estimated using a method which falls into a category known as the 'equivalent-adult' type which provided estimates of the long-run annual depression of yellow perch standing stocks and the yellow perch fisheries. A numerical model was developed which incorporated several population parameters including entrainment and impingement losses, and natural mortality rates for larvae, young-of-year and juveniles, and fishing mortality rates. (Deal-EIS)
W80-04701

THE EFFECT OF TEMPERATURE ON THE RESPIRATION RATE OF MEIOFAUNA,
Institute for Marine Environmental Research, Plymouth (England).
R. Price, and R. M. Warwick.
Oecologia, Vol 44, p 145-148, 1980. 2 Fig, 1 Tab, 19 Ref.

Descriptors: *Water temperature, *Respiration, *Inhibition, *Copepods, *Nematodes, Animal metabolism, Animal physiology, Benthic fauna, Statistical analysis, Mathematical models, *Polychaetes.

The effect of temperature on respiration rate has been established, using Cartesian divers, for the meiofaunal sabellid polychaete Manayunkia aestuarina, the free-living nematode Sphaerolaimus hirsutus and the harpacticoid copepod Tachidius discipes from a mudflat in the Lynher estuary, Cornwall, U.K. Over the temperature range normally experienced in the field, i.e., 5-20C the size-compensated respiration rate (Rc) was related to the temperature (T) in C by the equation Log10Rc = -0.635 + 0.0339T for Manayunkia, Log10Rc = 0.180 + 0.0069T for Sphaerolaimus and Log10Rc = -0.428 + 0.0337T for Tachidius, being equivalent to Q10 values of 2.19, 1.17 and 2.17 respectively. (Deal-EIS)
W80-04703

TOXIC DINOFLAGELLATES AND TIDAL POWER GENERATION IN THE BAY OF FUNDY, CANADA,
Institute for Marine Environmental Research, Plymouth (England).
P. C. Reid.
Marine Pollution Bulletin, Vol 11, p 47-51, 1980. 2 Fig, 34 Ref.

Descriptors: *Dinoflagellates, *Algal toxins, *Tidal energy, *Tidal powerplants, *Shellfish, Poisons, Tides, Flow profiles, Water circulation, Powerplants, Sedimentology, *Paralytic Shellfish Poisoning, *Bay of Fundy(Canada), Public health.

The incidence of Paralytic Shellfish Poisoning along the eastern seaboard of America has increased and spread during the last decade. One of the core areas for Paralytic Shellfish Poison (PSP), a poison that is derived from toxic dinoflagellates, is centred on the Bay of Fundy. It is in the upper reaches of the Bay of Fundy that a proposal has been made to construct a tidal power generation plant; this project would have a considerable effect on the water circulation, tidal regime and sedimentation characteristics of the Bay of Fundy and Gulf of Maine. Alterations such as these to the hydrography of this area may lead to changes in the occurrence of toxic dinoflagellates and the associated patterns and intensity of PSP. (Deal-EIS)
W80-04704

POLYCHLORINATED BIPHENYLS AND OTHER ORGANIC CHEMICAL RESIDUES IN FISH FROM MAJOR WATERSHEDS OF THE UNITED STATES, 1976,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W80-04706

A SIMPLE CONTINUOUS-FLOW TOXICANT DELIVERY SYSTEM,
Corvallis Environmental Research Lab., OR.
R. R. Garton.
Water Research, Vol 14, p 227-230, 1980. 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Research equipment, *Bioassay, *Methodology, Laboratory equipment, Equipment, *Toxicity, Water chemistry, Research and development, Chemical analysis, Chemical properties, *Aquatic organisms.

This paper describes a simple continuous-flow toxicant delivery system for use in testing toxicity of dissolved or suspended compounds to aquatic organisms. Its advantages are simplicity, ease of construction, and capacity for high flow rates. The system consists of a glass headbox and diluter box, a toxicant pump, a framework for support, and a system of tubes to deliver a series of toxicant concentrations to the test aquaria. Methods are given for construction and for calibration of the system. (Deal-EIS)
W80-04707

COMPARISON OF THE TOXICITY THRESHOLDS OF WATER POLLUTANTS TO BACTERIA, ALGAE, AND PROTOZOA IN THE CELL MULTIPLICATION INHIBITION TEST,
Bundesgesundheitsamt, Berlin (Germany, F. R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
G. Bringmann, and R. Kuhn.
Water Research, Vol 14, p 231-241, 1980. 10 Tab.

Descriptors: *Bioassay, *Methodology, *Water pollution effects, Chemical properties, Protozoa, Bacteria, Algae, Pseudomonas, Scenedesmus, Chlorophyta, Growth rates, Inhibition, Organic compounds, Aromatic compounds, Phenols, Inorganic compounds, *Toxicity.

Using analogous methods of the cell multiplication inhibition test, the toxicity threshold (TT) of 156 potential water pollutants was determined for model organisms of biological self-purification, i.e. bacteria of the species Pseudomonas putida, green algae of the species Scenedesmus quadricauda, and flagellate protozoa of the species Entosiphon sulcatum. From the number of 156 inorganic and organic pollutants tested, 23 exhibited a pronounced selective toxic action on Pseudomonas, 47 on Scenedesmus and 43 on Entosiphon. It is seen from the ratios found that a determination of the toxicity threshold of potential water pollutants for these three model organisms from the microbiological spectrum would provide a broader basis for assessing the damaging action of water pollutants to model organisms active in the biological self-purification of water. Ecotoxicological testing of potential water pollutants to evaluate their toxicity involving only one model organism of biological self-purification would give an incomplete and biased picture of the effects of pollutants. (Deal-EIS)
W80-04708

A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES,
Environmental Research Lab., Gulf Breeze, FL.
M. J. Hemmer.
Water Research, Vol 14, p 243-246, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Research equipment, *Bioassay, *Toxicity, *Aquatic organisms, Siphons, Equipment, Laboratory equipment, Chemical reactions, Pumps, Chemical analysis, Methodology, Shrimp, Endrin.

A halt-liter proportional diluter using positive pressure was designed and tested. Its primary siphons are activated by a pulse of pressure instead of by a partial vacuum as in conventional diluters. This method eliminates the need for venturi tubes, vacuum manifolds, and individual water blocks. Pressure can be supplied by air pumps, air cylinders, or air compressor lines. The diluter's advantages are ease of construction, calibration, compact size, and rapid cleaning. Unit cost is approximately $250.00. (Deal-EIS)
W80-04709

CORRELATION AND PREDICTION OF METAL TOXICITY TO AQUATIC BIOTA,
National Water Research Inst., Burlington (Ontario).
K. L. E. Kaiser.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 211-218, 1980. 6 Tab, 24 Ref.

Descriptors: *Physioc-chemical properties, *Metals, *Ions, *Toxicity, *Daphnia, Aquatic life, Sodium, Aluminum, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Mercury, Lead, Mathematical studies, *Arsenic, *Selenium, *Tin, Platinum, *Gold, *Beryllium, *Barium.

Published data on the toxicity of metal ions to aquatic biota, in particular Daphnia magna, were analyzed for their correlation with ion specific physicochemical parameters. Significant correlations were obtained for three groups of ions with similar electron configurations in the outer orbitals. Group I ions include Na, Be, Ba, Al, and Cr with inert gas-like electron configurations; group II ions include Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd, Pt,

Au, and Hg with partially or completely filled d electron orbitals; group III ions include Sn, As, Se, and Pb. The toxicity of an ion within a group can be calculated from a general equation. Delta IP. (Deal-EIS)
W80-04711

FACTORS CONTROLLING OXYGEN DEPLETION IN ICE-COVERED LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
J. A. Mathias, and J. Barica.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 185-194, 1980. 4 Fig, 2 Tab, 38 Ref.

Descriptors: *Lakes, *Dissolved oxygen, *Winter, Seasonal, Trophic level, Eutrophication, Oligotrophy, Winterkilling, Oxygen demand, Respiration, Sediments, Canada, *Oxygen depletion.

Winter oxygen depletion rates from four sets of Canadian lakes (prairie, southeastern Ontario, Arctic, and Experimental Lakes Area) differing in morphometry and trophic state, were analyzed. An inverse relationship was found between oxygen depletion rate and mean depth. The effect of lake trophic status on oxygen depletion rate was demonstrable after the influence of basin morphometry was removed by regression of oxygen depletion rate against the sediment area: lake volume ratio. The sediments of eutrophic lakes consumed oxygen about 3 times faster (0.23 g/sq m/d) than those of oligotrophic lakes (0.08 g/sq m/d), but water column respiration was about the same (0.01 g/cu m/d) for both groups of lakes. Data from prairie lakes showed that the winter oxygen consumption was limited by oxygen supply below an average whole-lake oxygen concentration of 3.8 mg/l. Implications for lake management during the winter are discussed. (Deal-EIS)
W80-04712

THREE TYPES OF SKIN PAPILLOMAS OF FLATFISHES AND THEIR CAUSES,
Hamburg Univ. (Germany, F.R.). Zoologisches Inst.
N. Peters, and B. Watermann.
Marine Ecology - Progress Series, Vol 1, p 269-276, 1979. 9 Fig, 17 Ref.

Descriptors: *Fish diseases, *Cytological studies, *Mode of action, Fish physiology, Animal pathology, Viruses, Water pollution effects, Metals, Sulfur compounds, Marine fish, *Papillomas, *Tumors, *Limanda, *Tissue analysis, *Neoplasms, Titanium compounds.

Three structurally different skin papillomas occur in flatfishes. Apparently, different causative agents are responsible. (1) Flat 'fish pox'-like tumours with a low connective tissue content occur in the Atlantic dab Limanda limanda. The high rate of occurrence in the German Bight (up to 6.6%) might be related to the dumping of wastes consisting of sulphuric acid and titanium compounds. (2) Collagen-rich papillomas on the tip of the lower jaw appear on both Atlantic and Pacific flatfishes kept in aquaria over long periods of time. These develop as a result of mechanical stimulation of the tissue as the fishes rub against aquarium walls. (3) Complex papillomas, composed in a characteristic manner of so-called X-cells and envelope cells between them, are common in flatfishes of the Pacific region. The structure and the distribution of these complex papillomas indicate that a virus is probably involved. There also exists some relationship between tumour occurrence rate and degree of coastal water pollution. (Deal-EIS)
W80-04713

ACUTE RESIDUAL TOXICITY OF SEVERAL DISINFECTANTS IN DOMESTIC AND INDUSTRIAL WASTE WATER,
Grand Valley State Colleges, Allendale, MI. Dept. of Biology.
R. W. Ward, and G. M. DeGraeve.
Water Resources Bulletin, Vol 16, No 1, p 41-48, 1980. 6 Tab, 20 Ref.

Descriptors: *Waste treatment, *Toxicity, *Freshwater fish, Bioassay, Chlorination, Bromine, Halogens, Chlorine, Industrial wastes, Sulfur compounds, Carp, Salmonids, Bioassay, Domestic wastes, Mortality, Benthic fauna, Disinfection, Daphnia, Minnows.

This study determined the acute toxicity of waste water disinfected with chlorine, bromine chloride, or ozone. The residual toxicity of effluent dechlorinated with sulfur dioxide was also tested. Toxicity tests were conducted with cyprinid, salmonid, and centrachid fishes, as well as several species of fresh water macro-invertebrates. Residual chlorine exhibited the greatest toxicity of the disinfectants tested; dechlorination with sulfur dioxide effectively eliminated the toxicity of chlorinated effluent. Residual ozone produced mortality in test animals only under special conditions where subjects were exposed to effluent immediately after it was contacted with ozone, and chlorobrominated effluent was more toxic to salmonids than chlorinated effluent. (Deal-EIS)
W80-04717

USING ARTIFICIAL STREAMS TO EVALUATE PERTURBATION EFFECTS ON AUFWUCHS STRUCTURE AND FUNCTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. R. Clark, J. H. Rodgers, Jr., K. L. Dickson, and J. Cairns, Jr.
Water Resources Bulletin, Vol 16, No 1, p 100-104, 1980. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Periphyton, *Biological communities, *Streams, Bioassay, Flow rates, Dominant organisms, Aquatic populations, Methodology, Research and development, Research equipment, Water pollution effects, *Artificial streams.

Artificial streams can assist in assessing the potential impact of pollutants on the structure and function of aquatic communities. While most artificial streams are constructed within a controlled environment or are maintained by recirculating water, we constructed a series of artificial streams along a river bank using river water on a once-through basis. This system was used to develop and test methods for structural and functional analyses of Aufwuchs communities. Only the flow rate and stream depth were controlled while individual streams were perturbed to obtain communities of altered ecological condition. This experimental system provided a relatively inexpensive series of treated and untreated streams which allowed an evaluation and comparison of methods using communities under various stressed and non-stressed conditions. Without the stabilizing effects of a controlled atmosphere or recirculating water, our approach demonstrated a degree of variability which approached that of the river. We inferred that the Aufwuchs community present in the artificial streams maintained a high degree of structural complexity and functional dynamism, providing a strong test of our methods and an opportunity to examine current ecological theory. (Deal-EIS)
W80-04718

GROWTH INHIBITION OF HYDRILLA VERTICILLATA BY SELECTED LAKE SEDIMENT EXTRACTS,
Southwest Florida Water Management District, Brooksville.
P. M. Dooris, and D. F. Martin.
Water Resources Bulletin, Vol 16, No 1, p 112-117, 1980. 2 Fig, 1 Tab, 29 Ref.

Descriptors: *Growth rates, *Inhibition, *Aquatic plants, *Iron, Bioassay, Lakes, Bottom sediments, Soil chemistry, Chemical properties, Chemical analysis, Plant growth, Biomass, Florida, *Hydrilla.

Sediments were investigated from two Florida lakes that have not been infested with the submersed, perennial, noxious plant Hydrilla verticillata. Aqueous extracts of the peat-like sediments from these lakes were shown to inhibit the growth of Hydrilla verticillata in laboratory systems. The extracts have substantial concentrations of organic carbor and iron. The apparent molecular weight of the inhibitory fraction is between 2,000 and 10,000, based upon ultrafiltration studies. Hydrilla growth was about 35 percent relative to control for a partially purified fraction at a level of 0.4 ppm organic carbon. Growth was measured as change in biomass (wet and dry) over a one-week period. The inhibitory material was highly fluorescent, dark brown, and inhibitory activity was lost after passage over an anion-exchange column (Cellex-D). (Deal-EIS)
W80-04719

EFFECTS OF DIETARY ASCORBIC ACID ON CHRONIC LEAD TOXICITY TO YOUNG RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries and Marine Service, Ottawa (Ontario). Great Lakes Biolimnology Lab.
P. V. Hodson, J. W. Hilton, B. R. Blunt, and S. J. Slinger.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 170-176, 1980. 7 Fig, 27 Ref.

Descriptors: *Lead, *Toxicity, *Rainbow trout, Fish diets, Vitamins, Nutrient requirements, Mode of action, Animal pathology, Fish diseases, Fish physiology, Water chemistry, *Tissue analysis, *Blood chemistry, *Ascorbic acid.

Newly hatched rainbow trout exposed to waterborne lead and receiving diets deficient in, or supplemented with, ascorbic acid, developed classical symptoms of lead toxicity and ascorbic acid deficiency. Those exposed to lead showed elevated blood lead concentrations, inhibition of erythrocyte Delta -amino levulinic acid dehydratase, darkening of the tail regions and spinal curvatures. Those receiving ascorbate deficient diets showed depletion of carcass, liver, kidney, and brain ascorbic acid concentrations plus spinal curvatures. Fish subjected to both treatments simultaneously showed no evidence of an enhancement of ascorbate deficiency symptoms by exposure to lead or enhancement or reduction of lead toxicity symptoms by ascorbate deficient or supplemented diets, respectively. These results demonstrate that, although aspects of lead toxicity in fish resemble ascorbic acid deficiency, there is no metabolic interaction between the two factors. (Deal-EIS)
W80-04720

EFFECTS OF TEMPERATURE AND SALINITY ON LARVAL DEVELOPMENT OF PAGURUS BERNHARDUS (DECAPODA, PAGURIDAE),
Biologische Anstalt Helgoland (Germany, F.R.).
R. R. Dawirs.
Marine Ecology-Progress Series, Vol 1, p 323-329, 1979. 12 Fig, 21 Ref.

Descriptors: *Water temperature, *Salinity, *Growth rates, *Crabs, Larval growth stage, Toxicity, Mortality, Salt tolerance, Mathematical models, Animal physiology, Water chemistry, Growth stages, Seasonal, Crustaceans.

The hermit crab Pagurus bernhardus L. was reared from egg to first crab stage at 6C, 12C and 18C. At 6C, development was completed after 107 to 112 d; at 12C, after 49 to 54 d; at 18C, after 33 to 35 d following hatching. Survival rates were 6.7% both at 6 and 18C; they were 20% at 12C. A simple graphical model was constructed which predicts occurrence, presence and settling of P. bernhardus larvae in the field. According to this model, in Helgoland waters (North Sea), duration of larval development lasts about 35 to 62 d, depending on the water temperature during and after hatching. Shortest development (about 35 d) is postulated for larvae hatching at the beginning of August. Complete rearing to metamorphosis was accomplished in 20% and 30% S (18C). In 10% S, Zoea 1 larvae exhibit 100% mortality 2 to 5 d after hatching. No differences in development duration, mortality, etc. were noticed at 20% and 30% S. The observation that a salinity of 20% does not cause recognizable stress is discussed in relation to local larval distribution. (Deal-EIS)
W80-04722

ACUTE TOXICITY OF HEAVY METALS TO AQUATIC INVERTEBRATES AT DIFFERENT TEMPERATURES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
L. P. Braginskiy, and E. P. Schcherban.
Hydrobiological Journal, Vol 14, No 6, p 78-82, 1978. 4 Tab, 9 Ref.

Descriptors: *Heavy metals, *Toxicity, *Invertebrates, *Water temperature, Cadmium, Zinc, Copper, Nickel, Manganese, Daphnia, Mayflies, Lethal limit, Bioassay, Animal physiology, Mortality, Copepods, Benthic fauna, Aquatic insects, Copepoda, Amphipods, Asellus.

Comparative toxicity of Cd, Zn, Cu, Ni, Mn ions at temperatures of 10, 15, 25 and 30C within the concentration range of 0.0025-5000 mg/liter was measured in acute 3-day experiments on six species of freshwater invertebrates. Maximum sensitivity to heavy metal ions is characteristic of Daphnia magna Straus young. Acanthocyclops viridis, Mayflies larvae and Asellus aquaticus are least sensitive. Cadmium is most toxic, followed by copper, zinc, nickel and manganese. As the temperature is raised to 25 to 30C, cadmium toxicity increases by 3 to 4 orders of magnitude, that of copper and zinc by 1 to 3 orders. (Deal-EIS)
W80-04723

THE STUDY OF EUTROPHICATION OF ALGAL BENTHOS BY ESSENTIAL METALS IN ARTIFICIAL RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
E. Eichenberger.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 111-128, 1978. 4 Fig, 8 Tab, 12 Ref.

Descriptors: *Heavy metals, *Eutrophication, *Rivers, Sewage effluent, Aquatic algae, Growth rates, Productivity, *Iron, *Manganese, *Cobalt, *Copper, *Zinc, Trophic level, Seasonal, Biomass, Trace elements, Toxicity, *Molybdenum.

The causes of eutrophication of rivers are being studied in artificial outdoor rivers. Small amounts of domestic sewage added to groundwater stimulates the growth of algae. This eutrophying effect cannot be duplicated by the supply of the same quantity of P04-P and/or N03-N as is found in the active sewage. The supply of a mixture of the 6 essential heavy metals Fe, Mn, Co, Cu, Mo and Zn on the other hand does affect the growth activity of the algae occurring naturally in the channels, whereby each metal most likely has a different effect. This results, depending on the season and the amount of mixture added, in changes of the sociological composition of the algal benthos and can considerably enhance the biomass accumulation. Due to the characteristic dose response of single algal species to individual metals the role of essential heavy metals in eutrophication is likely to be rather complex. (Deal-EIS)
W80-04726

GLYCERIA MAXIMA (HARTM.) HOLMB. IN PONDS SUPPLIED WITH POST-SEWAGE WATER,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5D.
W80-04730

ACIDITY AND SPECIES DIVERSITY IN FRESHWATER CRUSTACEAN FAUNAS,
Freshwater Biological Association, Windermere (England).
G. Fryer.
Freshwater Biology, Vol 10, p 41-45, 1980. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Acidic water, *Habitats, *Crustaceans, Dominant organisms, Lakes, Water chemistry, Acidity, Hydrogen ion concentration, *Calcium, Water temperature, *Species diversity, *Tarns.

On the basis of material from over seventy acidic water bodies in three different areas a relationship is revealed between pH and the species diversity of their crustacean faunas. With increasing acidity species diversity decreases. No such relationship is shown between calcium concentration and species diversity. The very low calcium levels of such waters may, however, play a part in the exclusion of certain species. (Deal-EIS)
W80-04731

CADMIUM TOXICITY TO THREE SPECIES OF ESTUARINE INVERTEBRATES,
Environmental Research Lab., Narragansett, RI.
G. G. Pesch, and N. E. Stewart.
Marine Environmental Research, Vol 3, p 145-156, 1980. 3 Fig, 5 Tab, 32 Ref.

Descriptors: *Cadmium, *Toxicity, *Crabs, *Shrimp, Heavy metals, Bioassay, Lethal limit, Mode of action, Mortality, Growth rates, Inhibition, Animal physiology, Invertebrates, Estuarine environment, *Scallop, *Argopecten, *Tissue analysis, *Bioaccumulation.

Three species of estuarine invertebrates, Palaemonetes pugio (grass shrimp), Pagurus longicarpus (hermit crab) and Argopecten irradians (bay scallop), were exposed to Cd in flowing seawater at concentrations of 0.06, 0.12, 0.25, 0.5 and 1.0 mg/litre. Incipient LC50 values of 0.53 and 0.07 mg/litre were estimated for bay scallop and hermit crab, respectively. The toxicity curve for grass shrimp had not stablished, but the incipient LC50 value was estimated to fall within a range of 0.2 to 0.3 mg/litre. Short-term response, as measured by time to 50% mortality at the highest Cd concentration, was 10, 21 and 23 days for the bay scallop, hermit crab and grass shrimp, respectively. Scallop growth was inhibited at all exposure concentrations with a measured 42-day EC50 value of 0.078 mg/litre Cd. Byssal thread detachment precedes death in bay scallops. An EC50 value of 0.54 mg/litre Cd for byssal detachment was measured on day 8 of the bioassay before appreciable mortality. This compared favourably with the incipient LC50 value of 0.53 mg/litre Cd. Cadmium accumulation occurred at all concentrations in bay scallop and grass shrimp. (Deal-EIS)
W80-04736

THE COMBINED EFFECT OF SALINITY, TEMPERATURE AND OIL ON THE GROWTH PATTERN OF EMBRYOS OF THE KILLIFISH, FUNDULUS HETEROCLITUS WALBAUM,
Texas A and M Univ., College Station. Dept. of Biology.
O. Linden, R. Laughlin, Jr., J. R. Sharp, and J. M. Neff.
Marine Environmental Research, Vol 3, p 129-144, 1980. 3 Fig, 4 Tab, 49 Ref.

Descriptors: *Killifishes, *Toxicity, *Oil, Water temperature, Salinity, Inhibition, Growth rates, Embryonic growth stage, Fish physiology, Oil spills, Oil pollution, Fuels, Fish diseases, Animal pathology, Mortality, *Teratology.

Embryos of the estuarine teleost, Fundulus heteroclitus, were exposed during development to different concentrations of the water-soluble fractions (WSF) of a No. 2 fuel oil under various temperature-salinity combinations. Temperatures and salinities were, respectively: 20, 25 or 30 and 10, 20 or 30 o/oo S. The WSF were extracted from No. 2 fuel oil daily and diluted to concentrations of 15, 20 or 25% of the original mixture. Controls were exposed to seawater without WSF at each temperature salinity combination. The length of eleutheroembryos was markedly decreased by exposure to WSF. Temperature exerted an effect on growth at low WSF concentrations (0 and 15% WSF) but not at higher ones. The two highest WSF concentrations had a predominant effect on growth that was not further modified by physical factor influences. Conversely, as the WSF exposure increased, the yolk diameter increased, indicating a decreased utilization of yolk material during development. The mean number of vertebrae in the eleutheroembryos decreased at high WSF concentrations and at high temperatures. Morphological abnormalities consisted predominantly of spinal deformations (scoliosis and lordosis). The data indicate that the survivors of chemical toxicity during embryo development exhibit sublethal responses which would reduce their survival potential in later life. (Deal-EIS)
W80-04737

A MARINE ALGAL BIOASSAY METHOD: RESULTS WITH PESTICIDES AND INDUSTRIAL WASTES,
Environmental Research Labs., Gulf Breeze, FL.
G. E. Walsh, and S. V. Alexander.
Water, Air, and Soil Pollution, Vol 13, p 45-55, 1980. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Bioassay, *Methodology, *Pesticide toxicity, *Industrial wastes, Toxicity, Marine algae, Diatoms, Growth rates, Inhibition, Pulp wastes, Herbicides, Spectrophotometry, Analytical techniques, *EPN, *Ethoprop, *Carbophenothion, *Methyl parathion, *DEF, *Phorate, *Carbaryl, *Benthiocarb, *Permethrin, *Neburon.

A simple marine algal bioassay method is described for short- and long-term studies on pesticides and industrial wastes. It can be used for rapid screening of a variety of substances with single-species and multiple-species tests and gives relative toxicities of the pollutants tested. Algae are grown in optically matched culture tubes that fit directly into a spectrophotometer, allowing population density to be estimated by absorbance without removal of samples. 96 h EC50 values for some pesticides and the diatom Skeletonema costatum are: EPN, 340 microg/l; carbophenothion, 109 microg/l; DEF, 366 microg/l; ethoprop, 8.4 mg/l; methyl parathion, 5.3 mg/l; and phorate, 1.3 mg/l. Presence of the chelator EDTA in medium had no effect on toxicity of carbaryl to S. costatum, Nitzschia angularum, Chlorococcum sp. and Chlorella sp. Liquid industrial wastes either stimulated growth, inhibited growth, or stimulated growth at low concentrations but inhibited it at higher concentrations. In mixed-species studies with the herbicide neburon, presence of a resistant species protected the sensitive species. Liquid industrial waste from a paper products plant caused changes in relative numbers, as compared to controls, when S. costatum and Porphyridium cruentum were grown together. (Deal-EIS)
W80-04740

CHLOROTIC DEATH OF LEMNA GIBBA BY CADMIUM IN DIFFERENT CONCENTRATIONS OF NUTRITIONAL MINERALS (IN JAPANESE),
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
M. Seto, Y. Takahashi, T. Ushijima, and T. Tazaki.
The Japanese Journal of Limnology, Vol 40, No 2, p 61-65, 1979. 6 Fig, 2 Tab, 12 Ref. (English Abstract).

Descriptors: *Cadmium, *Trace elements, *Mortality, *Aquatic plants, Plant physiology, Plant pathology, Proteins, Nutrient requirements, Water chemistry, Growth rates, Chemical analysis, *Lemna, *Tissue analysis.

The green frond of Lemna gibba turned into a chlorotic one and always died when cultured in a medium containing cadmium. The ratio of chlorotic fronds to total fronds was greatly affected by the difference in concentration of nutritional minerals even when the concentrations of cadmium in the medium were the same. The cadmium contents of L. gibba were also affected by the difference in concentration of nutritional minerals. The appearance of chlorotic frond was not explicable from the cadmium contents of L. gibba. When cultured in a high concentration of nutritional minerals, the chlorotic frond did not appear in spite of the high content of cadmium in the frond. On the other hand, when cultured in a low concentration of nutritional minerals, the chlorotic frond appeared in spite of the low content of cadmium in the frond. The protein content of L. gibba was changed considerably by the difference in concentration of nutritional minerals. This change in protein content might be related to differences in the

appearance of the chlorotic frond. To study the effect of a pollutant on an organisms, it will be necessary to understand the effect of an environmental condition on an organism as well as the amount of a pollutant accumulated by an organism. (Deal-EIS)
W80-04742

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5B.
W80-04745

BACTERIA: WHAT ARE THEY,
National Water Well Association, Worthington, OH.
S. Smith.
Water Well Journal, Vol 34, No 2, p 60-61, February, 1980.

Descriptors: *Bacteria, *Disinfection, Autoclaves, Digestion, E-coli, Iron bacteria, Soil bacteria, Sulfur bacteria, Speciation, Adaptation.

Bacteria are the simplest forms of self-sufficient organisms. Their structural simplicity enables them to reproduce quickly and create more resistant strains in response to chemical treatment. Some species form hard or gelatinous shells to withstand boiling water. Anaerobic bacteria can live without oxygen. Autoclaving (pressure cooking) at 121C and 15 psi for twenty minutes is the only sterilization technique that is 100 percent effective in destroying bacteria. But, where situations prohibit autoclaving, other techniques such as chlorination will suffice. Most bacteria are harmless or beneficial. E-coli bacteria helps us digest food. Soil bacteria digest dead plant and animal matter. This process is used in sewage treatment plants to make the effluent fit for further treatment. Harmful bacteria are those which cause discomfort and inconvenience to humans. Iron and sulfate-reducing bacteria are a nuisance but do not present a health hazard. (Purdin-NWWA)
W80-04748

5B. Sources Of Pollution

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: III. A CONCEPTUAL MODEL FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. Khaleel, G. R. Foster, K. R. Reddy, M. R. Overcash, and P. W. Westerman.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1353-1361, November-December 1979. 1 Fig, 3 Tab, 46 Ref, 3 Append. EPA R-805011-01-0.

Descriptors: *Water pollution sources, *Sediments, *Farm wastes, *Model studies, Mathematical models, Pollutants, Chemicals, Nitrogen, Phosphorus, Pesticides, Sediment transport, Erosion, Soil erosion, Rill erosion, Agricultural runoff, Agricultural watersheds, Agriculture, Hydrology, Nonpoint water pollution sources.

Some chemical pollutants are adsorbed to soil particles and transported with the sediment load. Sediments contain a mixture of particles of varying sizes and densities that have differing transport characteristics and affinities for chemical pollutants. In addition, manure particles are detached and transported by erosion processes during runoff events. A mathematical model was presented that describes the transport of various sediment particle types during unsteady overland-flow from manured areas. The present version of the model considers transport of four discrete particle fractions--fine primary, coarse primary, soil-aggregate, and manure particles. Sediment originates from two sources--interrill areas and rill areas. Two manure application modes, surface-applied or soil-incorporated, are recognized. The model operates with existing watershed hydrologic models and can be useful in studies of nonpoint source pollution from land areas receiving animal wastes. (Sims-ISWS)
W80-04515

A NONPOINT SOURCE MODEL FOR LAND AREAS RECEIVING ANIMAL WASTES: IV. MODEL INPUTS AND VERIFICATION FOR SEDIMENT AND MANURE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. Khaleel, G. R. Foster, K. R. Reddy, M. R. Overcash, and P. W. Westerman.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1362-1368, November-December 1979. 3 Fig, 8 Tab, 22 Ref. EPA R-805011-01-0.

Descriptors: *Water pollution sources, *Sediments, *Farm wastes, *Model studies, Mathematical models, Watersheds(Basins), On-site data collections, Erosion, Soil erosion, Rill erosion, Sediment transport, Suspended solids, Bed load, Runoff, Storm runoff, Agricultural watersheds, Agricultural runoff, Agriculture, Hydrology, Water pollution, Nonpoint water pollution sources.

A mathematical model describing transport of sediment and manure during unsteady overland flow from land areas receiving animal wastes was presented in a previous paper. Results of a comprehensive literature survey characterizing model inputs due to manure presence were presented in this paper. Inputs were: manure cover on the watershed, manure erodibility factor, and manure particle-size distribution and particle density. Estimated sediment yields were compared with measured data for selected storms on a 1.1-ha pasture watershed near Coshocton, OH. The simulated results agreed reasonably well with these field data. (Sims-ISWS)
W80-04516

EFFECTS OF SLASH BURIAL ON STREAM WATER QUALITY,
Washington Univ., Seattle. Coll. of Forest Resources.
A. G. Larson, and D. D. Wooldridge.
Journal of Environmental Quality, Vol 9, No 1, p 18-20, January-March 1980. 1 Tab, 14 Ref.

Descriptors: *Forestry, *Water quality, *Waste disposal, *Wood wastes, Forest management, On-site investigations, Sampling, Chemicals, Electrical conductance, Ions, Hydrogen ion concentration, Dissolved oxygen, Streams, Water chemistry, Chemical analysis, Data processing, Forests, Pollutants, Water pollution, Water pollution sources, Logging residue, Slash burial.

A 3-year study investigated impacts of buried logging residue on stream water composition. Burying of logging slash has been proposed as an alternative to burning. Residue was buried in trenches adjacent to two small ephemeral streams; one trench was filled with approximately 180 cu m of logging slash, the other with 94 cu m of mill residue. Streamflow was diverted to flow through the burial pits. Stream water samples collected from above (pretreatment) and below (post-treatment) the burial sites were analyzed for dissolved oxygen, pH, electrical conductance, alkalinity, temperature, K, Na, Ca, Mg, Fe, N03-N, NH4-N, S04-S, P04-P, total N, and total P. Changes in chemical composition occurring between pre- and post-treatment sampling sites were tested for significance using a paired sample t-test. With the exception of dissolved oxygen, surface water degradation resulting from burial was of no practical importance. Many ions decreased in concentration as waters passed through buried residue. Statistical comparisons of pre- and post-treatment water composition indicate significant increases were limited to H; pH decreased from 6.56 to 6.42 as a result of the buried slash. Oxygen depletion may be the most serious burial effect, with mean concentrations in the buried slash stream decreasing from 10 to approximately 8 mg/liter, a drop in oxygen saturation from 93 to 71%. (Sims-ISWS)
W80-04517

TRIFLURALIN MOVEMENT IN RUNOFF FROM A SMALL AGRICULTURAL WATERSHED,
Science and Education Administration, Tifton, GA.
W. A. Rohde, L. E. Asmussen, E. W. Hauser, R. D. Wauchope, and H. D. Allison.
Journal of Environmental Quality, Vol 9, No 1, p 37-42, January-March 1980. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Herbicides, *Runoff, *Watersheds(Basins), *Georgia, Sampling, Chemical analysis, Pesticides, Agricultural chemicals, Agricultural runoff, Grassed waterways, Agricultural watersheds, Rainfall, Simulated rainfall, Farm management, Agriculture, Water pollution, Path of pollutants, Trifluralin.

Little trifluralin moved in the surface flow from a small agricultural watershed located in the Southeastern Coastal Plain. Movement of trifluralin in 1974 and 1975 in surface water was 0.17 and 0.03%, respectively, of the total amount applied (1.12 kg/ha). Trifluralin movement in the shallow subsurface flow (above the 214 cm depth) was recorded only in 1974 and was negligible. Trifluralin was detectable in the soil from the 1974 application before the 1975 application. Soil concentration of trifluralin in 1974 was 320 ng/g (immediately after application) in the 0- to 10-cm depth and after 114 days the concentration decreased to 73 ng/g. However, no trifluralin was detected in the 30- to 60-cm depth 60 days after application. Simulated surface runoff from subplots on the watershed produced measurable concentrations of trifluralin 38 days after application, but it could not be detected after 71 days. Trifluralin movement was greater in runoff caused by simulated rainfall than that from natural rainfall due to the high application rate of water (19.1 cm/hour) and the lack of a vegetational buffer. Trifluralin loss in the simulated rainfall runoff water from a small plot directed through a 24.4-m waterway was reduced 96% under dry and 86% under wet conditions. Hence, trifluralin movement can be significantly reduced and possibly managed by buffer strips or vegetated waterways adjoining cropped areas. Appropriate use of these buffer areas should reduce to acceptable levels the chemical concentration in the runoff before the runoff reaches the surrounding streams. (Sims-ISWS)
W80-04518

EFFECTS OF WOOD PRODUCTS HARVEST ON FOREST SOIL AND WATER RELATIONS,
Northeastern Forest Experiment Station, Parsons, WV. Timber and Watershed Lab.
For primary bibliographic entry see Field 4C.
W80-04519

FERTILIZER NUTRIENT LOSSES FROM RANGELAND WATERSHEDS IN CENTRAL OKLAHOMA,
Science and Education Administration, Durant, OK.
A. Olness, E. D. Rhoades, S. J. Smith, and R. G. Menzel.
Journal of Environmental Quality, Vol 9, No 1, p 81-86, January-March 1980. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Range management, *Fertilizers, *Grazing, *Nutrient removal, *Oklahoma, Ranges, Watersheds(Basins), Rainfall, Runoff, Nutrients, Nitrogen, Phosphorus, Water quality, Erosion, Vegetation effects, Grasslands, Grasses, Range grasses.

Four native grassland watersheds were monitored for nitrogen and phosphorus nutrient losses in surface runoff. The watersheds, paired in surface hydrology and grazing management, were 8 to 11 ha in area with 3% slopes. One watershed of each pair was fertilized with 85 kg N/ha (as NH4(+)-N) and 75 kg P/ha surface broadcast. Ten 3.66 by 5.49 m (20 sq m) areas within each watershed were covered with plastic sheets during fertilization to provide unfertilized check plots. Fertilizer losses in surface runoff over the first year were 5% or less of the amounts applied. Soluble NH4(+)-N concentrations in surface runoff increased significantly only during the first month after fertilizer application. Soluble P concentrations incrased sharply after fertilization and remained relatively high even after 12 mo. Forage yields were increased 50

to 100% on fertilized areas. Increases in nutrient uptake of fertilized vegetation the first year equaled 17 to 25.5 kg/ha and 7.5 to 11 kg/ha of the added N and P, respectively. (Sims-ISWS)
W80-04520

PRECIPITATION ACIDITY: THE ROLE OF THE FOREST CANOPY IN ACID EXCHANGE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2K.
W80-04521

PHOSPHORUS VARIATIONS IN SURFACE RUNOFF FROM AGRICULTURAL LANDS AS A FUNCTION OF LAND USE,
Wisconsin Univ.-Madison. Dept. of Soil Science.
R. C. Wendt, and R. B. Corey.
Journal of Environmental Quality, Vol 9, No 1, p 130-136, January-March 1980. 8 Tab, 29 Ref.

Descriptors: *Phosphorus, *Agricultural runoff, *Nutrient removal, *Land use, Algae, Nutrients, Runoff, Water pollution, Water pollution sources, Eutrophication, Fertilizers, Farm wastes, Sediments, Infiltration, Crops, Forests, Agriculture, Nonpoint water pollution sources.

Phosphorus (P) carried in surface runoff from agricultural lands can be a major source of algal-available P in surface waters. The available P may include both dissolved and some fraction of the sediment-bound forms. In this study the effects of land use, time of year, and application of animal manure on several forms of P in runoff from farmed and forested lands were investigated. Simulated rain was used to generate runoff. Losses of dissolved molybdate-reactive P (DMRP), the majority of which is dissolved orthophosphate, were greatest from established or newly seeded alfalfa fields (Medicago sativa L.) in the fall after the foliage had been killed by frost. The fraction of total P lost as DMRP was greater for alfalfa than for corn (Zea mays L.) or a conventionally prepared seedbed. Greatest total P losses were from corn and seedbed areas due to greater sediment losses. Phosphorus potentially available to algae was estimated by extraction with hydroxy-aluminum resin. Amounts extracted were equal to DMRP plus an average of 17 and 34% of the remaining total P for samples with and without apparent sediment, respectively. Greatest losses were associated with highest sediment loads. Surface-applied manure on corn and alfalfa increased P concentrations in runoff but, due to increased infiltration, did not significantly increase P losses. Loss of P from forest land was less than from crop land. (Sims-ISWS)
W80-04523

PERSISTENCE OF FLURIDONE IN SMALL PONDS,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
D. C. G. Muir, N. P. Grift, A. P. Blouw, and W. L. Lockhart.
Journal of Environmental Quality, Vol 9, No 1, p 151-156, January-March 1980. 4 Fig, 5 Tab, 15 Ref.

Descriptors: *Herbicides, *Ponds, *Persistence, Aquatic weeds, Aquatic weed control, Water pollution, Pollutants, On-site investigations, Sampling, Sediments, Adsorption, Fish, Bioassay, Chemical degradation, Fluridone.

Fluridone was applied to three small ponds (5 by 3.5 sq m) to give water concentrations of 5,000, 700, and 70 micrograms/liter, respectively. Water, hydrosoil (0 to 3 and 3 to 6 cm depth), duckweed (Lemna minor), and minnows (Pimephales promelas) were collected for residue analysis over a 70-week period following herbicide application. The half-life of fluridone in the water column (0.5 m depth) ranged from 4 (at 700 micrograms/liter) to 7 days (70 micrograms/liter). Upon retreatment of one of the ponds the following year at 100 micrograms/liter, a half-life of 4 days was observed. Fluridone persisted in hydrosoils with an apparent half-life of 1 year or more at all treatment levels. Retreatment of one of the ponds resulted in a buildup of herbicide residue which dissipated more rapidly (half-life of 20 weeks) than after the first treatment. Bioassays indicated that fluridone residues in hydrosoil from the ponds treated at 700 and 5,000 micrograms/liter, taken 42 to 70 weeks after treatment, were phytotoxic to duckweed. Fluridone levels in minnows were very low (less than 0.02 to 0.14 microgram/g) throughout the sampling period with bioconcentration factors ranging from 0 to 64. Fluridone levels in duckweed were proportional to the herbicide concentrations in the pond water with bioconcentration factors ranging from 19 to 85. (Sims-ISWS)
W80-04524

A COMPARISON OF COMPOSITE SAMPLING TECHNIQUES FOR MONITORING RUNOFF,
Wisconsin Univ.-Madison. Dept. of Soil Science.
T. C. Daniel, R. C. Wendt, P. E. McGuire, and D. Stoffel.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1310-1312, November-December 1979. 2 Fig, 1 Tab, 6 Ref. EPA G005139-01.

Descriptors: *Runoff, *Pollutants, *Sampling, *Monitoring, Data processing, Analytical techniques, Pollutant identification, Suspended solids, Nitrogen, Phosphorus, Nutrients, Water pollution sources, Agricultural runoff, Agriculture.

The technical feasibility of using a flow proportional composite sample for determining event loads was evaluated using runoff data from an ongoing watershed investigation. For the same event, loads were calculated and compared using the following methods: (1) discrete event load (DEL), (2) composite event load (CEL), and (3) three sample mean event load (SMEL). The DEL method is based on standard integration techniques using the concentration of individual discrete samples taken at preselected runoff intervals (proportional to flow). The CEL procedure utilizes the concentration of a flow proportional composite sample in combination with total volume of runoff, whereas the SMEL method uses the mean concentration of three selected samples taken on the basis of time into the event. DEL data were assumed to be true value and serve as a basis of comparison for the CEL and SMEL procedures. A highly significant correlation was shown to exist between the DEL and the CEL and SMEL methods for all parameters analyzed, i.e., suspended solids (SS) and nitrogen and phosphorus components. Slopes and intercepts of each method for all parameters approached one and zero, respectively. No significant difference between the CEL and SMEL methods was detected, although there appeared to be a tendency for the SMEL method to overestimate the loads of SS and associated parameters for large events. Both the CEL and SMEL methods are technically sound and result in considerable savings in analysis cost. The advantages of the CEL over the SMEL method, especially for new monitoring programs, are that additional savings in analysis cost can be realized along with the elimination of considerable amounts of hand labor. (Sims-ISWS)
W80-04525

IMPACT OF UNCONFINED LIVESTOCK ACTIVITIES ON WATER QUALITY,
Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering.
J. W. D. Robbins.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1317-1323, November-December 1979. 8 Tab, 32 Ref. EPA R804497.

Descriptors: *Water quality, *Pastures, *Livestock, *Agricultural runoff, Effects, Water pollution sources, Erosion, Sedimentation, Farm management, Land use, Pollutants, Path of pollutants, Coliforms, Biochemical oxygen demand, Nitrogen, Phosphorus, Agriculture, Reviews, Unconfined livestock impact.

Current knowledge related to environmental effects of grazing animals was presented. All available data indicate that pollutant yields from pasture and rangeland operations are not directly related to the number of animals or amount of wastes involved. Rather, they are intimately related to hydrogeological and management factors and are best described as the results of the erosion/sediment phenomenon. (Sims-ISWS)
W80-04526

MIXING PROCESSES ON THE ATLANTIC CONTINENTAL SHELF, CAPE COD TO CAPE HATTERAS,
California Univ., Berkeley. Dept. of Civil Engineering.
H. B. Fischer.
Limnology and Oceanography, Vol 25, No 1, p 114-125, January 1980. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Mixing, *Circulation, *Continental shelf, *Atlantic Ocean, Water circulation, Ocean circulation, Dispersion, Water pollution, Currents(Water), Ocean currents, Water temperature, Sewage, Coliforms, Bacteria, Path of pollutants, Current meters, Aerial photography, Oceanography, *Middle Atlantic Bight.

Data from moored current meters and airborne and satellite observations were used in conjunction with analyses of shear flow dispersion to estimate the dispersion of dissolved substances in the Middle Atlantic Bight during unstratified periods. The long-shelf dispersion coefficient was estimated to be of the order of 10,000-100,000 sq cm/s, and the cross-shelf dispersion coefficient of the order of 300,000 sq cm/s at midshelf. The cross-shelf estimate was a factor of 10 less than previous ones, which were based on the assumption that the cross-shelf flux of freshwater is equal to the inflow from tributary rivers within the bight itself. (Sims-ISWS)
W80-04532

WATER-QUALITY CHARACTERISTICS OF STREAMS IN FORESTED AND RURAL AREAS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons, and R. C. Heath.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149834, Price code: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-108, 1979. 49 p, 15 Fig, 6 Tab, 15 Ref.

Descriptors: *Water quality, *Streams, *Forests, *Rural areas, *North Carolina, Water pollution sources, Natural streams, High flow, Low flow, Environmental effects, Geochemistry, Baseline studies, Storm runoff, Chemical analysis, Evaluation.

Data collected in North Carolina during 1973-78 from a statewide network of 39 rural sampling sites were used to define unpolluted or baseline stream quality. The basins were 90 to 100 percent forested and, except for the unknown effects of air pollution, were relatively unaffected by man's activities. Five distinct geochemical zones were delineated across the State. The chemical characteristics of surface waters in each zone are similar. Mean and other statistical values for major dissolved constituents, nutrients, and minor elements in base runoff and storm runoff were determined. Twenty additional rural sites were located in basins where farming activities ranged from 15 to 55 percent of basins' land area. Data from these 20 sites were used for comparison with data from the 39 unpolluted sites to determine the increase in constituent levels caused by man. For basins where farming activities accounted for 20 or more percent of total land use, phosphorus levels were 2 to 13 times greater than those from the forested basins and several major constituents were 2 to 3 times greater. Concentrations of minor elements were essentially the same in both developed and undeveloped basins. (Kosco-USGS)
W80-04558

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),

For primary bibliographic entry see Field 6E.
W80-04582

SOLUBILITY OF SELECTED MAJOR AND MINOR ELEMENTS FROM COAL, GOB AND FLY ASH ACCUMULATIONS,
Kansas Water Resources Research Inst., Manhattan.
D. A. Kopsick, and E. E. Angino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175334, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, March 1980. p 26, 10 Fig, 2 Tab. OWRT-A-087-KAN(1).

Descriptors: *Coals, *Water pollution, *Leachates, *Groundwater, *Fly ash, Leaching, Ion transport, Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Zinc, Copper, Lead, Cadmium.

Nine different fly and bottom ashes, representing four coal producing areas of the United States were used in leaching experiments for Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Pb, and Cd and the potential for contamination of ground and surface water supplied by these elements. Both fly ash and bottom ash are formed by the thermal decomposition or dehydration of inorganic impurities in coal and vary with the type of coal used. Many factors affect leachate characteristics such as coal preparation methods, method and efficiency of combustion, method of disposal, particle morphology, and others. Glass columns 2 ft in length, 2 in in diameter, and packed with 18 in of sample were used to study the leachates. Distilled, deionized water was used as the leaching solution. Three leaching patterns were observed: (1) a hyperbolic curve with a large initial flush of elements followed by leveling off, (2) a constant release especially for calcium, and (3) a delay in time before maximum release concentration. Missouri coal leachate was rich in Pb, Zn, Cu, Fe, Mn, and Cd. This richness combined with a pH of 3.0 gives the Missouri coal the greatest potential for groundwater contamination. Low trace metal concentrations were observed for Wyoming fly and bottom ashes, but they were high in K, Na, Ca, and Mg. Kentucky and Illionis coals gave intermediate results. (Seigler-IPA)
W80-04604

PUBLIC HEALTH ASPECTS OF LAND DISPOSAL OF SUGAR REFINING WASTES BY SPRAY IRRIGATION,
North Dakota State Univ., Fargo. Dept. of Bacteriology.
B. R. Funke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175359, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University Research Project Technical Completion Report, October 1979. p 9. OWRT A-057-NDAK(1).

Descriptors: *Salmonella, *Sprinkler irrigation, *Sugar beets, *Public health, Coliforms, Waste water disposal, Soil microbiology, Irrigation practices, Irrigation water, Water resue, Irrigated land, Alfalfa, Agriculture, Bacteria.

The potential of a public health hazard caused by the spray irrigation disposal of sugar beet processing wastes contaminated with Salmonella bacteria was investigated at the Hillsboro, North Dakota plant of the American Crystal Sugar Company. Incoming sugar beets are washed, sliced, and processed for sugar extraction. At times all water used is not recycled and lime-mud waters are pumped into an irrigation lagoon and disposed of by spray irrigation. Most-probable-number methods using selective and differential media were used to enumerate the bacteria from various locations in the processing sequence and in the disposal lagoons used. Fecal coliforms were also enumerated by standard methods. Results show that the processing water of the plant often had large populations of both Salmonella and fecal coliform bacteria. Salmonella were found in the irrigation lagoon at some times during the year but not during the warmer months when spraying was done. No Salmonella were found in the soil sprayed with the lagoon water. The source of Salmonella at the plant was found to be the tare soil on the incoming beets. The soil was also the source of the fecal coliforms. However, neither fecal coliforms or Salmonella were found in beet field soils and farmers denied using animal wastes as fertilizer in the fields. The study does not indicate any public health problems as a result of spray irrigation disposal of the sugar beet processing wastes. (Seigler-IPA)
W80-04608

EFFECT OF CLIMATE AND TEMPERATURE ON THE AMOUNT OF HC03(-) AND H2C03 OF GROUNDWATERS (INFLUENCE DU CLIMAT, DE LA TEMPERATURE SUR LA TENEUR EN HC03(-) ET H2C03 DES EAUX SOUTERRAINES),
For primary bibliographic entry see Field 2F.
W80-04623

CHEMICAL TRACERS FOR PARTICLE TRANSPORT IN THE CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton, V. Grant, and M. G. Gross.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 75-83, January 1980. 4 Fig, 2 Tab, 31 Ref. DOE EY76-S02-3292.

Descriptors: *Suspended solids, *Turbidity, *Sediment transport, *Tracers, *Chesapeake Bay, Trace elements, Pollutants, Nutrients, Metals, Iron, Titanium, Zinc, Sampling, Chemical analysis, Rivers, Water pollution, Water pollution sources, Estuaries, *Susquehanna River(MD).

Particulate material from the Susquehanna River is enriched in Fe (5-7%), allowing it to be distinguished from other sources of particles in surface waters of the Chesapeake Bay. Although the turbidity maximum removes most of the river-borne detritus, chemical composition of suspended particle matter (SPM) indicates that Susquehanna River materials dominate the inorganic suspended matter in surface waters of the Bay at least 20-40 km further. Fe concentrations, Fe/Ti, and Fe/Zn ratios in surface water SPM still farther down the Bay indicate that those particles are a mixture of river derived and biological material and that shore erosion is not normally a source of surface water suspended sediments as far as the mouth of the Potomac. Seasonal variations of elemental ratios such as Fe/Zn can also be used to demonstrate scavenging of soluble trace elements by particles during summer conditions. (Sims-ISWS)
W80-04632

CHLORIDE DISPLACEMENT BY WATER IN HOMOGENEOUS COLUMNS OF THREE SOILS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2G.
W80-04639

NITROGEN AND WATER DISTRIBUTIONS IN FERTILIZED SANDY SOIL DURING IRRIGATION AND DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W80-04642

TURBULENCE PREDICTION IN OPEN CHANNEL FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-04645

CHLOROPHYLL TURNOVER IN SKELETONEMA COSTATUM, A MARINE PLANKTON DIATOM,
Brookhaven National Lab., Uptown, NY. Dept. of Energy and Environment.
D. M. Riper, T. G. Owens, and P. G. Falkowski.
Plant Physiology, Vol 64, No 1, p 49-54, July 1979. 7 Fig, 1 Tab, 17 Ref. EY-76-C-02-0016.

Descriptors: *Skeletonema costatum, *Chlorophyll, *Marine plants, *Tracking techniques, Diatoms, Chlorophyll-a, Chlorophyllide-c, Plankton, Tracers, Radioisotopes, Cytological studies, Aminolevulinic acids(ALA), Dye dispersion, Radioactivity techniques, Photosynthesis.

Radioactively-labeled Aminolevulinic acids (ALA) were incorporated into the chlorophylls of Skeletonema costatum, a marine plankton diatom. It was noted that normal cells of S. costatum took up significant extracellular ALA, even though they were originally thought to be impermeable to primary amino acids. Up to 2% of the total ALA uptake was incorporated into chlorophyll-a and chlorophyllide-c. Radioactive ALA was not directly incorporated into carotenoid or xantophyll pigments. The addition of 0.5 micro mole ALA to the culture media did not alter the rates of cell division of chlorophyll-a and chlorophyllide-c accumulation from those of untreated cells. Pigment specific activity of chlorophyllide-c was greater than that of chlorophyll-a. The incorporation of radioactive ALA into chlorophyll-a and chlorophyllide-c pools in stationary cultures of S. costatum was rapid and reached equilibrium after 10 hours. Cells which have been exposed to radioactive ALA for 48 hours and had attained a density of one million cells/ml were resuspended in fresh media at a density of 300,000 cells/ml. Complete dilution of the labeled pigment pools was not observed. The initial rapid loss of label was followed by a period of little or no loss and a specific activity of the pool of about 30% of the maximum attained before the resuspension. Beyond 15 hours the pigment pools showed a trend of increased labeling. The dilution of chlorophyll-a and chlorophyllide-c pools labeled with ALA hydrogen and carbon isotopes indicated that C14 incorporation began 20 hours after the resuspension, and was accompanied by slight increase in H3 labeling. (Harris-Wisconsin)
W80-04659

THE RIVER LAXA ECOSYSTEM, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
For primary bibliographic entry see Field 2E.
W80-04663

COMPARATIVE CARBOHYDRATE STORAGE AND UTILIZATION PATTERNS IN THE SUBMERSED MACROPHYTES, MYRIOPHYLLUM SPICATUM AND VALLISNERIA AMERICANA,
Wisconsin Univ.-Madison. Dept. of Botany.
J. E. Titus, and M. S. Adams.
The American Midland Naturalist, Vol 102, No 2, p 263-272, October 1979. 3 Fig, 1 Tab, 35 Ref. NSF DEB-19-777; AG 40-193-69.

Descriptors: *Carbohydrates, *Nutrient requirements, *Myriophyllum spicatum, *Vallisneria americana, *Plant growth regulators, Lake Wingra(WI), Submerged plants, Aquatic weed control, Nuisance algae, Biomass, Seasonal, Rooted aquatic plants, Metabolism, Productivity, Macrophytes, Growth rates.

The hypothesis that ample storage of total nonstructural carbohydrates (TNC) by Vallisneria americana could support a growth flush to compensate for its short growing season was tested by the analysis and comparison of plant tissues of Myriophyllum spicatum and Vallisneria americana. Myriophyllum and Vallisneria plants were collected at four stations on Lake Wingra, Madison, Wisconsin. Sampling was conducted during annual cycles in 1974 and 1975. The sampling methods were designed in such a manner that it was possible to quantify shoot/root ratios. Both species exhibited marked seasonal patterns in percentages of TNC in above and below-sediment plant parts. Mean TNC values in M. spicatum ranged from 1.6-19.0% for roots and 2.0-20.0% for shoots. The low values were associated with the spring growth flush. V. americana tissues ranged from 4.0-28.0% TNC during the growing season, while winter bud TNC values were 45%. However, since the winter

biomass was quantitatively low, the total winter reserves of V. americana community were inadequate to permit compensation for a late start in spring. Thus, the proposed hypothesis that ample storage of TNC by V. americana could support a growth flush to compensate for its short growing season was rejected. (Harris-Wisconsin)
W80-04665

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.

Water and Wastes Engineering, Vol. 17, No. 2, p 30-33, 63, February, 1980. 2 Fig, 2 Tab.

Descriptors: *Groundwater, *Water pollution control, *Organic wastes, *Public health, *Water pollution sources, *Water pollution treatment, Carcinogens, Toxicity, Septic tanks, Landfills, Leachate, Leakage, Sewerage, Storage tanks, Waste disposal, Waste storage, Accidents, Aeration, Carbon filters, Resins, Adsorption, Oxidation, Biodegradation, Costs.

The use of ground water for both water supply and waste disposal often results in contamination from toxic compounds. Little attenuation of these organic contaminants occurs in aquifers. The effects of toxic chemicals on human health are debatable but safe levels must be established. A preliminary list of 13 carcinogens published by the EPA shows cancer risk increases with increasing contaminant levels. Also shown are the maximum noncarcinogenic levels for various lengths of exposure. Over the past 12 to 15 months more than 25 Massachusetts municipal water supplies and numerous private wells have been contaminated by organics. Contaminant sources included: septic systems, landfill leachate, sewer system leaks, storage tank leaks, industrial waste lagoons, accidental spills, and illegal disposals. Aquifer decontamination requires a considerable amount of time and expense. Methods for removal of organics include aeration, carbon adsorption, synthetic resin adsorption, oxidation, and biodegration. A combination of processes is the most effective approach. The cost of this treatment will greatly exceed the cost of surface water treatment. Future organic contamination should be prevented by establishing aquifer protection zones, managing septic systems, repairing sewer system leaks, controlling major chemical discharges, and regulating the construction and testing of storage tanks. (Purdin-NWWA)
W80-04666

QUANTIFICATION OF NON-POINT WATER POLLUTANTS FROM LOGGING, CATTLE GRAZING, MINING, AND SUBDIVISION ACTIVITIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-04669

AN ENVIRONMENTAL STUDY OF THE ORIGIN, DISTRIBUTION, AND BIOACCUMULATION OF SELENIUM IN KENTUCKY AND BARKLEY LAKES,
Kentucky Water Resources Research Inst., Lexington.
B. E. McClellan, and K. J. Frazer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176118, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 122, 1980. 44 p, 11 Fig, 5 Tab, 6 Ref. OWRT A-075-KY(1), 14-34-0001-8019, 14-34-0001-9019.

Descriptors: *Trace elements, Deposition(Sediments), Water quality, Chemical analysis, *Lakes, *Streams, *Sediments, *Fish, Kentucky, Tennessee, Atomic absorption spectrometry, Bioaccumulation.

Samples of water, bottom sediment, and fish were analyzed for toxic metal ion content. The samples were collected from several selected sites along Kentucky and Barkley Lakes as well as the Cumberland River and several sub-impoundments along these aquatic systems. Emphasis was placed on selenium, although several other metal ions were determined. The results showed that there are no serious pollution problems with As, Cd, Cr, Cu, Hg, Pb, Se, Sr, Zn, or Zr at any of the sites examined. Actually, none of the trace metals examined even come close to the EPA limits on fish, with the exception of lead in the White Crappie and mercury in the Bass. There appears to be no serious problem with lead in White Crappie as only two fish out of a total of nineteen were above the limit of 2 PPM. The same holds for mercury in the bass as only three fish out of thirty-four were above the 0.5 PPM level. Water and sediment analyses for the above mentioned metal ions fell well within expected 'normal' limits for unpolluted fresh water systems. No point sources could be identified for any of the metal ions. This is in contrast with results obtained on the lower Tennessee River by Hancock, et al, in which a large chemical complex was found to contribute significant quantities of trace metals. No significant seasonal variation of trace element content was observed in any of the sample types. Since the selenium content of all samples was so low, no laboratory bioaccumulation data were obtained. No general correlation between fish length and trace element content could be established.
W80-04672

DESK TOP METHODOLOGY FOR MODELING BIOCHEMICAL OXYGEN DEMAND IN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 7B.
W80-04673

ACCUMULATION OF 210PB IN FRESHWATER PLANTS,
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
D. P. Marchyulenene, R. F. Dushauskene-Duzh, E. B. Moteyunene, V. B. Nyanishkene, and G. G. Polikarpov.
Hydrobiological Journal, Vol 14, No 6, p 73-77, 1978. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Lead, *Adsorption, *Aquatic plants, Absorption, Heavy metals, Lead radioisotopes, Physicochemical properties, Water chemistry, Hydrogen ion concentration, Plant physiology, Plant pathology, Mode of action, Membrane processes, *Bioaccumulation, *Tissue analysis.

The uptake of 210Pb by aquatic plants take place mainly by adsorption on the cell walls. The accumulation rate of 210Pb is determined by its physicochemical state in the water, pH and communicative properties of cell walls. It also depends on Ca concentration in the water, the strength of its adsorption on cell walls, and the amount of stable lead in the plants and bottom sediments. In investigating the toxic effect of lead on Nitellopsis obtusa it was found that lead in a concentration of 0.5 mg/liter causes a lowering of protoplasm movement rate and partial destruction of cells and rhizoids. At concentration of 20.7 mg/liter, all cells and rhizoids die. (Deal-EIS)
W80-04692

STUDIES ON THE BINDING OF HEAVY METALS TO ALGAL POLYSACCHARIDES FROM PHILIPPINE SEAWEEDS. I. CARRAGEENAN AND THE BINDING OF LEAD AND CADMIUM,
Philippines Univ., Diliman, Quezon City. Marine Sciences Center.
R. L. Veroy, N. Montano, L. B. de Guzman, E. C. Laserna, and G. J. B. Cajipe.
Botanica Marina, Vol 23, p 59-62, 1980. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Heavy metals, *Absorption, *Marine algae, Effects, Cadmium, Lead, Path of pollutants, Chemical analysis, Spectrophotometry, Metabolism, Biochemistry, Sulfates, *Seaweeds, *Carrageenan.

The metal-binding properties of the sulfated polysaccharides k- and l-carrageenan from Eucheuma striatum and Eucheuma spinosum are investigated by dialysing solutions of carrageenan against solutions of lead and cadmium salts. Alternatively, solutions of these metal cations are eluted through a column of the coarsely ground alga. The amounts of lead and cadmium bound by the polysaccharide are determined by atomic absorption spectrophotometry. Carrageenan is found to effectively bind both heavy metals, exhibiting a greater, though not significantly pronounced, affinity for lead. Metal binding capacity is correlated with the degree of sulfation of the carrageenan molecule. (Deal-EIS)
W80-04694

THE EFFECTS OF MERCURY EXPOSURE ON INTRACELLULAR DISTRIBUTION OF MERCURY, COPPER AND ZINC IN SKELETONEMA COSTATUM (GREV.) CLEVE,
British Columbia Univ., Vancouver. Dept. of Oceanography.
L. Cloutier-Mantha, and D. A. Brown.
Botanica Marina, Vol 23, p 53-58, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Mercury, *Copper, *Zinc, *Diatoms, Bioassay, Absorption, Metabolism, Path of pollutants, Heavy metals, Growth rates, Inhibition, Toxicity, Mode of action, Biochemistry, Mode of action, *Skeletonema.

The effects of exposure to low concentrations of HgC12 on the intracellular levels of Cu, Zn and Hg in S. costatum grown in artificial seawater were determined. An attempt was made to determine whether mercury-induced synthesis of metallothionein-like substance could be responsible for sequestering heavy metals in a diatom. Short-term exposure to 1.84 nM HgC12 resulted in a reduced growth rate and cell density, possibly due to the toxic effects of Hg which mainly accumulated in the high molecular weight pool. Pre-exposure to 1.84 nM HgC12 prior to exposure at 5.53 nM HgC12 resulted in a lower accumulation of Hg in the high m.w. pool. Exposure to 0.37 nM HgC12 was sufficient to alter the levels and distribution of intracellular Cu and Zn. Upon Hg exposure, Zn levels decreased in high and low m.w. fractions but gradually increased in the medium m.w. pool. Copper slightly increased in the high m.w. pool but remained constant in the medium and low m.w. pools in relation to total intracellular levels. The increase of Zn in the medium m.w. pool, in Hg-exposed cultures, the low levels of Cu and Zn in the medium m.w. fractions, and the absence of aromatic amino acids, suggest that metallothionein may play a role in storage or detoxification of heavy metals in S. costatum. High levels of Cu and Zn in the low m.w. pool may indicate that a substance of lower m.w. than usually reported for metallothionein-like substance also may play a role in the storage and detoxification of heavy metals in S. costatum. (Deal-EIS)
W80-04695

TISSUE METAL CONCENTRATIONS IN TWO CRAYFISH SPECIES COHABITING A TENNESSEE CAVE STREAM,
Savannah River Ecology Lab., Aiken, SC.
For primary bibliographic entry see Field 5A.
W80-04696

UPTAKE AND ELIMINATION OF ANTIMONY IN THE MUSSEL, MYTILUS EDULIS,
Institute fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5C.
W80-04697

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
T. G. Miller, and W. C. Mackay.
Water Research, Vol 14, p 129-133, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Toxicity, *Copper, *Water chemistry, Rainbow trout, Hardness(Water), Alkalinity,

Hydrogen ion concentration, Lethal limit, Mortality, Chemical reactions, Chemical analysis, Mathematical models, Statistical analysis.

Rainbow trout were used to determine the effects of water alkalinity and hardness on the incipient lethal concentration (ILC) of copper. At low water hardness (12 ppm) the ILC of copper was not affected by a five-fold change in medium alkalinity (10-50 ppm); however in hardwater (98 ppm) the same change in alkalinity caused the ILC to increase by 1.8 times. The ILC for copper increased as hardness increased regardless of alkalinity. At pHs of less than 5.4 the toxicity of various combinations of copper and hydrogen ion were antagonistic but at pH 5.4 there appeared to be some synergism between pH and Cu toxicity. (Deal-EIS)
W80-04699

EFFECTS ON RAINBOW TROUT (SALMO GAIRDNERI) OF A CHRONIC EXPOSURE TO WATERBORNE SELENIUM,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Lab.
P. V. Hodson, D. J. Spry, and B. R. Blunt.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 233-240, 1980. 1 Fig, 5 Tab, 28 Ref.

Descriptors: *Toxicity, *Rainbow trout, *Metals, Lethal limit, Embryonic growth stage, Mortality, Mode of action, Fish eggs, Fish physiology, Monitoring, *Selenium, *Tissue analysis, *Bioaccumulation, *Blood chemistry.

The 96-h and 9-d LC50s of selenium for rainbow trout averaged 8.1 and 6.5 mg/l, respectively. A sublethal exposure of rainbow trout from the newly fertilized egg stage until 44 wk posthatch to 4.4-53 microg/l of waterborne selenium resulted in a variety of subtle responses. Significantly increased mortality of eyed eggs was observed at selenium concentrations greater than or equal to 28 microg/l and decreased red blood cell volumes and cellular blood iron at concentrations greater than or equal to 53 and 16 micro/l, respectively. Although the highest eyed egg mortality at 47 microg/l selenium was double that of control, total mortality was only 6.5%. Similarly, the blood parameters decreased from control levels by a maximum of 30% and the fish appeared to be compensating for these changes by increased erythropoiesis. Overall, the fish responded to selenium exposure at concentrations between 100 and 250 times the normal background concentrations in surface waters but the level of response was low. Analyses of tissue selenium at 44 wk posthatch indicated that residues clearly reflected exposure, that liver, digestive tract, and kidney accumulated the highest residues, that selenium tissue concentrations may be regulated, and that specific tissues provide a better basis for monitoring selenium exposure than whole body analyses. (Deal-EIS)
W80-04714

EFFECTS OF DIETARY ASCORBIC ACID ON CHRONIC LEAD TOXICITY TO YOUNG RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries and Marine Service, Ottawa (Ontario). Great Lakes Biolimnology Lab.
For primary bibliographic entry see Field 5A.
W80-04720

THE STUDY OF EUTROPHICATION OF ALGAL BENTHOS BY ESSENTIAL METALS IN ARTIFICIAL RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5A.
W80-04726

RESPIRATORY PROPERTIES OF ERYTHROCRUORIN (EXTRACELLULAR HEMOGLOBIN) IN THE BLOOD OF THE ANNELID ARENICOLA MARINA WITH SPECIAL REFERENCE TO THE INFLUENCES OF SALINITY AND TEMPERATURE,
Aarhus Univ. (Denmark). Dept. of Zoophysiology.
K. K. Rasmussen, and R. E. Weber.
Ophelia, Vol 18, No 2, p 151-170, 1979. 10 Fig, 1 Tab, 37 Ref.

Descriptors: *Annelids, *Respiration, *Salinity, *Water temperature, Animal physiology, Animal metabolism, Salt tolerance, Hydrogen ion concentration, Water chemistry, Oxygen, Carbon dioxide, *Acclimation, *Blood chemistry, *Hemoglobin, *Erythrocruorin.

Acclimation of Arenicola marina to high salinity increases the 02 affinity of the erythrocruorin in the blood compared to that in low-salinity acclimated animals. At pH 7.4 and 20C, the 02 tensions required for half-saturation (P50) are 2.1 and 3.3 mm Hg at water salinities of 32.3 and 10.2 o/oo, respectively. Acclimation salinity, however, does not appear to exert a consistent influence on the Bohr effect or the buffer capacity of the blood, although the buffer reserve is higher in low-than in high-salinity acclimated animals. The influence of temperature on the 02 affinity of the blood is small and appears to be independent of salinity. Acclimating batches of Arenicola to 6 and 18C, however, produced no evidence for thermo-acclimatory changes in blood 02 affinity. Curiously a specific effect of C02 (i.e. one which is not related to concomitant pH change) increases 02 affinity of the erythrocruorm rather than decreasing it as in vertebrate hemoglobin. The data are discussed as regards their possible adaptive significance to the worms in burrowing and intertidal habitats. (Deal-EIS)
W80-04728

SOME EFFECTS OF SALINITY AND TEMPERATURE ON THE OSMOTIC AND IONIC REGULATION OF PRAUNUS FLEXUOSUS (CRUSTACEA, MYSIDACEA) FROM ISEFJORD,
Stirling Univ. (Scotland). Dept. of Biology.
D. S. McLusky.
Ophelia, Vol 18, No 2, p 191-203, 1979. 3 Fig, 5 Tab, 30 Ref.

Descriptors: *Salinity, *Water temperature, *Toxicity, *Osmosis, Crustaceans, Membrane processes, Salt tolerance, Mortality, Sodium, Potassium, Calcium, Magnesium, Chlorides, Animal physiology, *Osmoregulation, *Acclimation, *Blood chemistry.

The salinity tolerance, osmotic regulation and ionic regulation of the mysid crustacean, Praunus flexuosus, collected at the Isefjord, Denmark, has been investigated over a range of salinities, and at temperatures from 5 to 20C for both winter and summer animals. Survival at low salinities was enhanced when the animals were kept at low temperatures, and this enhancement was especially pronounced in animals collected in winter. A clear pattern of hyper/hypo-osmotic regulation was found, but no effect of season or temperature on the osmotic concentration was observed. The blood concentration of Isefjord animals was significantly lower at any given salinity than that of previously studied animals from Loch Etive, Scotland. This reduction is considered to be due to long-term acclimation, and the findings are compared with other crustacea where studies have been made on distinct populations. The blood concentrations of sodium, potassium, calcium, magnesium and chloride were determined at three salinities, and found when totalled to account for the osmotic concentrations. (Deal-EIS)
W80-04729

OSMOTIC RESPONSES OF EGGS AND LARVAE OF THE PACIFIC HERRING TO SALINITY AND CADMIUM,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
D. F. Alderdice, T. R. Rao, and H. Rosenthal.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol 32, p 508-538, 1979. 10 Fig, 11 Tab, 33 Ref.

Descriptors: *Cadmium, *Salinity, *Toxicity, *Herrings, Larval growth stage, Membrane processes, Osmosis, Fish eggs, Fish physiology, Mode of action, Heavy metals, Salt tolerance, Water chemistry, Pacific herring, *Osmoregulation.

Pacific herring (Clupea pallasi) eggs fertilized in 20 o/oo S and incubated in 5, 20 or 35 o/oo S at 5C, some being cross-transferred between 5 and 35 o/oo S, 61.8 hr after fertilization, showed variable yolk and perivitelline fluid (PVF) osmolalities until beginning of epiboly. Coincident with blastopore closure and for a period of ca. 150 hr thereafter (period of stability), both yolk and PVF osmoconcentrations were relatively constant. Thereafter osmolalities rose slowly to asymptotic levels prior to hatching. An hypothesis is presented whereby minimum osmotic work is defined on the basis of isosmotic relations existing between yolk, perivitelline fluid, and incubation medium. This leads to the description of a range of salinities defined in terms of osmoregulatory scope. The presence of a salinity-temperature interaction and its influence on the association between osmoregulatory scope and production of viable larvae is suggested as a mechanism underlying and providing the recognized plasticity of Pacific herring egg development. In a companion study involving cadmium as a contaminant, eggs incubated at 20 o/oo S were exposed to 0, 1 or 10 ppm Cd in 5, 20 or 35 o/oo S for 48-hr periods at six stages of development between fertilization and hatching. Cd exposure resulted in a reduction in osmolality of perivitelline fluid. Reduction was greater in higher Cd concentrations and in eggs transferred to higher salinities. (Deal-EIS)
W80-04733

LIVER CADMIUM UPTAKE, CATALASE INHIBITION AND CADMIUM THIONEIN PRODUCTION IN THE KILLIFISH (FUNDULUS HETEROCLITUS) INDUCED BY EXPERIMENTAL CADMIUM EXPOSURE,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
R. J. Pruell, and F. R. Engelhardt.
Marine Environmental Research, Vol 3, p 101-111, 1980. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Cadmium, *Toxicity, *Killifishes, Heavy metals, Inhibition, Enzymes, Biochemistry, Fish physiology, Animal metabolism, Copper, Chemical analysis, Mode of action, Bioassay, *Tissue analysis, *Bioaccumulation, *Liver.

Liver catalase activity was used as an index of cadmium poisoning in the killifish, Fundulus heteroclitus, and was found to be inhibited following both in vivo and in vitro exposure to dissolved cadmium at a concentration greater than 1 mg/litre. Pre-exposure at 1 mg Cd/litre prevented catalase inhibition at higher subsequent doses of cadmium. Comparison of the effects of in vivo and in vitro exposure showed in vivo exposure to cadmium to result in greater catalase inhibition. Cadmium and copper binding was determined by gel chromatography and found to occur at three distinct liver cytosol fraction peaks. Both metals showed enhanced cytosol concentrations with cadmium exposure and relative changes in peak levels as related to cadmium exposure regimes. Cadmium thionein (molecular weight of 7-10,000) was found in the killifish liver and was correlated with adaptive responses in liver catalase activity. High molecular weight cadmium binding was found to be a better index of cadmium toxicity to liver catalase than total liver cadmium concentration. (Deal-EIS)
W80-04738

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
D. Bacon.
Water Well Journal, Vol 34, No 2, p 37, February, 1980. 1 Fig.

Descriptors: *Heat pumps, *Environmental effects, *Computer models, On-site investigations, Effluents, Waste water disposal, Thermal pollution, Injection wells, Ground water.

The National Water Well Association and the University of Missouri, Rolla are examining the effects

of heat pump effluent injection on ground water temperature distribution and chemical equilibria. Hydrogeologic and climatologic data from a field site will be used to develop a computer model that will predict the nature and distribution of thermal plumes resulting from injection of heat pump discharge water under various conditions. This model will eventually predict the environmental impact resulting from high-density usage of ground water heat pumps. (Purdin-NWWA)
W80-04745

PREVENTING GROUNDWATER POLLUTION: TOWARDS A COORDINATED STRATEGY TO PROTECT CRITICAL RECHARGE ZONES,
Environmental Defense Fund, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04800

5C. Effects Of Pollution

GUIDELINES FOR SURFACE WATER QUALITY, VOL. 1, INORGANIC CHEMICAL SUBSTANCES, SELENIUM,
Inland Waters Directorate, Ottawa (Ontario).
A. Demayo, M. C. Taylor, and S. W. Reeder.
1979. 21 p, 1 Fig, 145 Ref.

Descriptors: *Water quality control, *Potable water, *Aquatic life, *Wildlife, *Toxicity, *Irrigation, *Industrial water, Baseline studies, Selenium, Distribution, Recommendations.

A literature survey was carried out on the toxic effects of selenium compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum selenium concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-04568

GUIDELINES FOR SURFACE WATER QUALITY, VOL 1, INORGANIC CHEMICAL SUBSTANCES, NICKEL,
Inland Waters Directorate, Ottawa (Ontario).
M. C. Taylor, A. Demayo, and S. W. Reeder.
1979, 12 p, 89 Ref.

Descriptors: *Water quality control, *Water quality standards, *Potable water, *Aquatic life, *Wildlife, *Toxicity, *Irrigation, Industrial water, Baseline studies, Distribution, Recommendations.

A literature survey was carried out on the toxic effects of nickel and nickel compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum nickel concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-04571

PHOTOSYNTHESIS AND GROWTH OF SPIRULINA PLATENSIS (CYANOPHYTA) IN AN EQUATORIAL LAKE (LAKE SIMBI, KENYA),
California Univ., Santa Barbara. Dept. of Biological Sciences.
J. M. Melack.
Limnology and Oceanography, Vol 24, No 4, p 753-760, July 1979. 4 Fig, 4 Tab, 19 Ref. NSF GB8328X and BMS 75-03441.

Descriptors: *Lake Simbi(Kenya), *Photosynthesis, *Growth rates, *Chlorophyll, *Spirulina, Cyanophyta, Euphotic zone, Dissolved oxygen, Volcanoes, Craters, Phytoplankton, Primary productivity, Limnology, Analytical techniques, Methodology, Physicochemical properties, Plant growth, Secchi disks, Surface waters, Kenya.

Abundance, growth and photosynthetic rates of a unialgal population of Spirulina platensis in Lake Simbi, Kenya were investigated August 1973-May 1974 and November 1976. Chlorophyll-a concentrations and S. platensis numerical abundance are usually exceptionally high within 1 m of the surface. During morning calm period S. platensis trichomes often accumulate at the surface. Maximal photosynthetic rates are usually high and vary 950-12,900 mg 02/cu m h; areal photosynthetic rates, determined by depth profile planimetry, range 620-5,220 mg 02/sq m h. Photosynthetic capacity in Lake Simbi is variable. Maximal photosynthetic capacity values range 1-19 mg 02/mg chl-a h and values for the euphotic zone vary 1-11.2 based on bottled phytoplankton. Estimates of maximal photosynthetic capacity for the euphotic zone range 7.1-24.2 mg 02/mg chl-a h based on free water determinations of dissolved oxygen. Exceptionally high photosynthetic rates are due to the extraordinary chlorophyll-a content in the euphotic zone (200-650 mg chl-a/ sq m). Growth rate measurements based on actual weight changes yield turnover times of 8.9-18.9 h. Lake Simbi lies 1,142 m a.s.l. and occupies a volcanic explosion crater 1 km from Lake Victoria. Seston are dull green because of dense S. platensis suspensions. Secchi disk readings vary 21-70 cm. Waters are alkaline and saline. (Danovich-Wisconsin)
W80-04647

GROWTH AND LONGEVITY IN THE CRUSTOSE RED ALGA PETROCELIS MIDDENDORFFII,
Washington Univ., Seattle. Dept. of Zoology.
R. T. Paine, C. J. Slocum, and D. O. Duggins.
Marine Biology, Vol 51, No 2, p 185-192, 1979. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Rhodophyta, *Plant growth, *Waadah Island(WA), *Life history studies, *Age, *Intertidal areas, Benthic flora, Growth rates ecology, Rocks, Algae, Distribution, Population dynamics, Mortality, Plant populations, Plant morphology, Photography, Polargraphic analysis, Petrocelis middendorffii.

Petrocelis middendorffoii, a noncalcareous red alga living in the middle-upper portion of an intertidal zone on Waadah Island, Washington, grows slowly; recruitment and mortality rates are low and the alga is capable of attaining great age. Observations were made at Waadah Island near Neah Bay, Washington, April 1970-August 1977. Total spatial separation of the four clusters studied was less than 17 m; however, indications of regional performance synchrony within this limited area were not observed. Some plants were growing; others were fragmenting. Plant surface area increased 4%/yr for those individuals growing. Age estimates, based on various growth rates, suggest that an average sized plant, 123 sq cm, is 25-87 years old. Plants of small or reduced area are more susceptible to death than larger ones; however, death does not directly relate to plant age. Causes of mortality are unknown. All plant portions are readily accessible to molluscan grazers, three of which, Collisella digitalis, Littorina sitkana and L. scutulata, are locally common. Plant periphery areas may be less edible than the central portion and the latter has an excellent capacity to re-establish itself, probably from those portions retained in the rock matrix. Petrocelis is a crustose sporophyte, prodicing tetraspores, which in turn give rise to a foliose dioecious gametophyte. Each P. middendorffii site was photographed at 1-6 mo intervals; photographs were projected and the algal surface area measured with a compensating polar planimeter. (Danovich-Wisconsin)
W80-04651

CONTINUOUS PLANKTON RECORDS: SEASONAL CYCLES OF PHYTOPLANKTON AND COPEPODS IN THE NORTH ATLANTIC OCEAN AND THE NORTH SEA,
Institute for Marine Environmental Research, Plymouth (England).
J. M. Colebrook.
Marine Biology, Vol 51, No 1, p 23-32, 1979. 10 Fig, 18 Ref.

Descriptors: *Phytoplankton, *Seasonal, *Copepods, *North Sea, *Atlantic Ocean, *Distribution, Water temperature, Upwelling, Overwintering sites, Spatial distribution, Temporal distribution, Population dynamics, Surface waters, Graphical analysis, Timing, Thermocline, Grazing, Correlation analysis, Coasts, Surveys, Growth rates, Standing crops.

Data from the Continuous Plankton Recorder survey of the North Atlantic Ocean and North Sea, 1960-1976, show that a key distribution factor for phytoplankton is the timing of the spring increase; copepod abundance is determined by the length of time food is available rather than food amounts. Distribution of overwintering stocks also influences seasonal distributions. Phytoplankton increases correlate with seasonal temperature ranges. Rapid spring increases in phytoplankton standing stocks occur over most of the open ocean which, compared with shallow water areas , si underexploited by grazing. Due to low overwintering stocks and longer generation times, copepods are unable to increase quickly enough to graze down phytoplankton within the limited growing season. In the open ocean, spring phytoplankton increases correspond with spring warming of surface waters. In the North Sea, the spring increase occurs earlier, associated with transient vertical stability periods. This results in a relatively slower increase rate. Exceptionally early spring phytoplankton increases off the Norwegian shelf and west coast of Greenland are associated with permanent haloclines. West Greenland has an exceptionally high phytoplankton standing stock relative to copepods for the whole productive season, due to low temperatures which restrict copepod development. High, late autumn, phytoplankton peaks off the coast of Portugal are due to coastal upwelling. The Grand Banks off Newfoundland are characterized by very sharp, high, spring phytoplankton peaks due to regional shallowness and low temperatures which restrict copepod growth. (Danovich-Wisconsin)
W80-04652

THE UPTAKE OF UREA BY THE DIATOM, PHAEODACTYLUM,
University Coll. of Swansea (Wales). Dept. of Botany and Microbiology.
T. A. V. Rees, and P. J. Syrett.
The New Phytologist, Vol 82, No 1, p 169-178, January 1979. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Ureas, *Diatoms, *Metabolism, *Kinetics, *Cytological studies, *Absorption, Nitrogen, Light, Plant physiology, Ammonium compounds, Phaeodactylum, Diffusion, Cultures, Laboratory tests, Chromatography, Darkness, Photoactivation, Nutrients, Nutrient requirements, Cycling nutrients, Tracers.

Urea-grown Phaeodactylum cells possess an active transport mechanism with a high-affinity for urea; presumably such high-affinity active mechanisms allow phytoplankton to utilize nitrogenous compounds at low, naturally-occurring, sea water concentrations. The mechanism leads to C14 accumulation in cells; 80% of C14 is recovered from cells as unchanged C14-urea. C14-urea uptake rates are much faster than passive diffusion rates; the half-saturation constant varies 0.6-1.0 microM. Uptake, low in cells cultured with ammonium as the nitrogen source actively develops when these cells are incubated in nitrogen-free medium for 24 h. Cycloheximide additions stop this development, indicating dependence on protein synthesis and a specific membrane protein. Uptake activity, but not urea affinity, is greatly stimulated when urea-grown cells are deprived of nitrogen 10-24 h. C14-urea uptake continues until a constant level is attained within the cells; this plateau value results from a balance between active urea uptake rates and passive diffusion loss rates. Urea transport takes place in both light and darkness, but in nitrogen-replete cells, rates in darkness are slow and are greatly stimulated by illumination. DCMU does not cause significant inhibition; however, CCCP causes almost complete inhibition, indicating that light stimulation occurs by ATP arising from photophosphorylation. (Danovich-Wisconsin)
W80-04653

THE OCCURRENCE OF A HYPERSENSITIVE REACTION IN THE PLANKTONIC DIATOM ASTERIONELLA FORMOSA HASSALL PARASITIZED BY THE CHYTRID RHIZOPHY-

DIUM PLANKTONICUM CANTER EMEND., IN CULTURE,
Freshwater Biological Association, Windermere (England).
H. M. Canter, and G. H. M. Jaworski.
The New Phytologist, Vol 82, No 1, p 187-206, January 1979. 2 Fig, 3 Tab, 30 Ref.

Descriptors: *Diatoms, *Fungi, *Parasitism, *Resistance, Metabolism, Cultures, Laboratory tests, Hosts, Microbiology, Microscopy, Infection, Mortality, Spores, Population, Growth stages, Asexual reproduction, Asterionella formosa, Rhizophydium planktonicum, Plant physiology, Cytological studies.

Hypersensitive reactions of plant cells in response to fungal parasitism takes place between cells of freshwater planktonic diatom Asterionella formosa clone CRB05 when infected by chytrid Rhizophydium planktonicum clone C2. Experiments show that most cells which react at a hypersensitive level result in failure of chytrids to increase and reach epidemic proportions on particular diatom clones in culture. Within Asterionella clone CRB05, hypersensitivity protects the total population from increasing parasitism but this does not protect individual cells. Cell reactions, either compatible or hypersensitive and incompatible, together with relative populations, make for a successful or unsuccessful host-parasite relationship. Most diatom Asterionella formosa cells in this study exhibit a hypersensitive death reaction in response to chytrid infections. On these incompatible cells, the fungus died and the encysted zoospore did not enlarge into a sporangium. However, compatible cells did bear sporangium in rare instances. Throughout this study, 4000 hypersensitively killed cells of Asterionella clone CRB05, each bearing one zoospore, were recorded. In contrast, fungus development beyond the zoospore stage occurred in only 20 cells. Therefore, most parasitized cells are classed as incompatible (hypersensitive). Experiments focused on detailed high-power light-microscope observations of numerous algal and fungal cells. (Danovich-Wisconsin)
W80-04654

SIZE-SELECTIVE PREDATION OF ZOOPLANKTON,
Ithaca Coll., NY. Dept. of Biology.
J. L. Confer, and G. Applegate.
The American Midland Naturalist, Vol 102, No 2, p 378-383, October 1979. 1 Fig, 2 Tab, 18 Ref. NSF URP SMI176-83107.

Descriptors: *Zooplankton, *Predation, *Food habits, *Particle size, Browse utilization, Animal behavior, Food chains, Diaptomus sicilis, Diaptomus pallidus, Daphnia pulex, Daphnia magna, Cyclops vernalis, Macrocyclops albidus.

Selection of prey by three species of predacious zooplankton species was analyzed. One three predators (Epischura lacustris, Macrocyclops albidus, and Cyclops vernalis) and three to ten prey (Diaptomus sicilis, D. pallidus, Daphnia pulex, and D. magna) were placed into aquaria. All aquaria were examined every 24 hours. The results were expressed as number of prey killed rather than eaten. The number of prey killed per predator/day ranged from 0.2 with Cyclops vernalis up to 4.2 with Macrocyclops albidus. Estimated predation rates showed large weekly variations. These variations may reflect real differences that occur in nature over a short time interval. Higher rates of predation were observed at higher densities. When offered a choise of prey, the predators generally selected the smallest prey and avoided the largest prey. In some experiments selection for the smallest prey occurred regardless of whether the smallest prey was a copepod or a cladoceran. The smallest prey used in these experiments were not as small as some which are available to zooplankton in lakes. Consequently, the results of the experiments do not necessarily suggest the smallest prey that the predators are capable of eating, nor the size of prey that the predators would prefer when a natural range of sizes is available. (Harris-Wisconsin)
W80-04655

A CONTRIBUTION TO THE PHOSPHORUS LOADING CONCEPT,
Technische Univ., Dresden (German, D.R.). Bereich Hydrobiologie.
J. Benndorf.
Internationale Revue der Gesamten Hydrobiologie, Vol 64, No 2, p 177-188, 1979. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Eutrophication, *Model studies, *Orthophosphate, *Detention reservoirs, Estimating equations, German Democratic Republic, Organic loading, Phosphorus, Phytoplankton, Sedimentation, Growth rates, Light intensity, Reservoirs, Cycling nutrients.

Two modifications were tested on the empirical eutrophication model developed by Vollenweider and Dillon (1974) and Vollenweider (1976): (1) Total phosphorus is replaced by orthophosphate phosphorus; (2) An outwash limit is introduced for very short residence times. The new orthophosphate-related constants of the model have been calculated for reservoirs. These new values differ from the original constants chiefly in that the new sinking velocity values for oligotrophic reservoirs are different from values for mesotrophic and eutrophic man-made lakes. This difference is caused by the vertical stratification of orthophosphate and the deep water outlet from reservoirs. The time-dependent outwash limit is also calculated from the equation. Critical orthophosphate load limits have been checked using mean values from 19 reservoirs and primary reservoirs located in the German Democratic Republic. A high degree of conformity between the model and the measured eutrophication state has been found. In addition, the outwash limits have been tested by means of random sampling at the primary reservoirs Weida and Bautzen. Of 17 samples only one did not fit the model. (Harris-Wisconsin)
W80-04656

THE CHEMISTRY OF LAKE MYVATN AND RIVER LAXA,
Marine Research Inst., Reykjavik (Iceland).
J. Olafsson.
Oikos, Vol 32, No 1-2, p 82-112, 1979. 16 Fig, 22 Tab, 46 Ref.

Descriptors: *Water chemistry, *Lake Myvatn(Iceland), *River Laxa(Iceland), Eutrophication, Nitrogen, Phosphorus, Cyanophyta, Anabaena flos-aquae, Hypolimnion, Diatoms, Lake morphology, Cycling nutrients, Iceland, Nutrients.

High phosphorus loading of Lake Myvatn, Iceland is the primary cause of the dense algal blooms which develop in the lake. The nitrogen/phosphorus ratio is too low for green algae. However, the excess phosphorus is utilized by blooms of the nitrogen fixing blue-green alga Anabaena flos-aquae. As a result of the high production rate of organic matter in winter in the lake, oxygen-deficient conditions may develop in some parts of the lake. The lake has a short water retention time. However, much of the hypolimnion is isolated under the ice by thermal stratification from the water flowing through the lake. The diatom mining operation in the Ytrifloi basin exceeds the rate of sediment deposition and is responsible for changes in the morphological characteristics of the basin. By 1977 the volume of the lake has increased by 32%. In addition, the mining operation has also affected the nutrient chemistry of the springs which drain into the basin. Phosphorus and nitrogen loading rates have increased by 20% and 96% respectively, and at present only a fraction of the mobilized nutrients find their way back to the lake. Decrease in phosphorus content of the mining effluents would be desirable. Phosphorus decrease would cause a decrease in the annual production of algal biomass and a change in the nitrogen/phosphorus ratio which in turn would eliminate many of the nitrogen fixing algae such as Anabaena that cause periodic algal blooms in the lake. (Harris-Wisconsin)
W80-04657

SECONDARY PRODUCTION OF EPILITHIC FAUNA IN A WOODLAND STREAM,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
R. J. Neves.
The American Midland Naturalist, Vol 102, No 2, p 209-225, October 1979. 1 Fig, 6 Tab, 75 Ref.

Descriptors: *Secondary productivity, *Streams, *Epilithic fauna, *Aquatic insects, Factory Brook(MS), Trophic level, Benthos, Food chains, Biomass, Diptera, Ephemeroptera, Trichoptera, Plecoptera, Massachusetts.

In July 1973 three sets of 40 cobblis were placed across a riffle in Factory Brook, Massachusetts in order to sample the biomass and productivity of epilithic fauna. One 40-cobble set was sampled each month from September 1973 to August 1975, allowing three months for recolonization. Insect order according to numerical abundance were Diptera (55.8%), Ephemeroptera (31.9%), Trichoptera (7.3%), and Plecoptera (1.8%) for the two-year period with little variation between years. In 1975 the mean faunal density was 3088 individuals/sq m. Seasonal changes in epilithic fauna generally reflected differences in numerical abundance during the year. Mayflies dominated cobble biomass, followed by caddis flies, stone flies and dipterans; the occurrence of other orders was extremely variable but significant during several months. Total biomass on cobbles amounted to 646.7 mg dry weight/sq m/year in 1974 and 610 mg dry weight/sq m in 1975. Estimated annual production on cobbles during 1974 was 4804.9 mg dry weight/sq m/year and 4315.1 mg dry weight/sq m/year in 1975. Most of the invertebrate production on cobbles was attributed to relatively few abundant and common species. Predators made up 18.5-20.4% of the biomass and contributed 11.1-13.6% of invertebrate production on cobbles. The remaining biomass and production was attributed to herbivores and detritivores. Annual energy production was 24.7 kcal/sq m in 1974 and 22.3 kcal/sq m in 1975. (Harris-Wisconsin)
W80-04658

THE OXYGEN BALANCE OF LAKE MYVATN, ICELAND,
Miljoestyrelsen, Silkeborg (Denmark). Freshwater Lab.
C. Hunding.
Oikos, Vol 32, No 1-2, p 139-150, 1979. 11 Fig, 7 Tab, 30 Ref.

Descriptors: *Lake Myvatn(Iceland), *Oxygen, *Primary productivity, Oxygen demand, Eutrophication, Benthos, Water temperature, Oxygenation, Cladophora aegagropila, Diatoms, Photosynthesis, Sediment-water interfaces, Iceland, Phytoplankton.

During 1973 and 1974 in-situ limnological experiments were conducted at Gardsvogar Beach, Lake Myvatn, Iceland. In this area, cold spring water overflows sediment submerged only 0.5 m below the water surface, and keeps it clean of detrital material. The purpose of the experiments was to quantify the rates of benthic microalgal production and community respiration by following the oxygen change in the water over the sediment in light and dark undisturbed sediment cores. Oxygen uptake of the sediment community correlated with the temperature of the water over the sediment. Variations of water movement over the sediment also affected the rate of community oxygen uptake. Based on measured values of oxygen production and uptake of the sediment community, daily oxygen production was calculated at about 800 mg 02/sq m, and community oxygen uptake at about 1300 mg 02/sq m during July-August. Net oxygen change amounted to +689 mg 02/cu m from 0600 to 2040 hours, and -576 mg 02/cu m from 2040 to 0600 hours. Daily net oxygen production at 80 cm water depth was +113 mg 02/cu m. Colonies of Cladophora which grew on the bottom of the central parts of the lake were locally abundant and reached densities of 1,800,000 individuals/sq m in 1973. They were well adapted to illumination intensities at the sediment surface. In spite of the positive daily oxygen balance of the lake, a marked decline in oxygen balance occurred during storms due to increased oxygen uptake by the suspended sediments. (Harris-Wisconsin)

W80-04661

ZOOPLANKTON AND ITS RELATION TO AVAILABLE FOOD IN LAKE MYVATN,
National Energy Authority, Reykjavik (Iceland).
H. Adalsteinsson.
Oikos, Vol 32, No 1-2, p 162-194, 1979. 25 Fig, 4 Tab, 113 Ref.

During the ice-free seasons in 1972 and 1973 and the ice-bound season in 1972, water samples were taken from 16 stations evenly distributed through all three basins of Lake Myvatn, Iceland. The whole water column was sampled at each station. The number of individuals from different zooplankton taxonomic groups was counted in each sample. Biomass of phyto- and zooplankton was estimated by calculating the volumes of the geometric configurations of the organisms. Due to shallowness of the lake (ca. 2 m) sediment is often suspended and quantitatively dominates phytoplankton. Among the phytoplankton, chrysomonads dominate in winter. After ice break they are replaced by diatoms. These in turn are followed by a new peak of chrysomonads. Anabaena flos-aquae dominates during summer, and diatoms again during autumn. Among the zooplankton, Cyclops abyssorum Sars is dicyclic, with the first generation appearing in spring and the second in July-August. The total zooplankton production was 30-100 g fresh weight/sq m. Annual fluctuations were mainly dependent on Daphnia production. Phytoplankton biomass averages 2-2.5 times higher, and production 10-20 times higher than corresponding values for zooplankton. The differences in the zooplanktonic species composition between the three basins of the lake are caused by the combination of the following factors: bloom of Anabaena, fish predation, and sediment suspension. (Harris-Wisconsin)
W80-04662

PHYTOPLANKTON PRODUCTION IN SHALLOW EUTROPHIC LAKE MYVATN, ICELAND,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
P. Jonasson, and H. Adalsteinsson.
Oikos, Vol 32, No 1-2, p 113-138, 1979. 21 Fig, 9 Tab, 76 Ref.

Descriptors: *Lake Myvatn(Iceland), *Phytoplankton, *Primary productivity, Eutrophication, Water temperature, Ice cover, Opacity, Light penetration, Cycling nutrients, Radiation, Chlorophyll, Benthos, Diatoms, Photosynthesis, Chrysophyta, Anabaena flos-aquae, Seasonal, Iceland, Solar radiation.

Lake Myvatn is a shallow eutrophic lake in northeastern Iceland consisting of three irregular basins. During the six year period between 1971-1976, samples for measurement of primary gross production were collected at six stations on the lake. In addition, physical and chemical properties of the lake environment, such as water temperature, ice cover, global radiation, transparency, wind speed, resuspension and nutrient budget, were measured. The southern basin produced 118 g C/sq m/year; the northern basin produced 75 g C/sq m/year; and the eastern basin produced 50 g C/sq m/year. Availability of phosphorus seems to limit phytoplankton production. Seasonal succession of phytoplankton followed a trend similiar to that of temperate eutrophic lakes. The phytoplankton succession was: diatoms in spring and autumn, chrysophyceans in early summer and autumn, Anabaena flos-aquae in summer. The chlorophyll content was low in spring and early summer and dropped rapidly after the high values during the Anabaena bloom. Intermittently high values observed regularly in autumn were associated with resuspended benthic diatoms. High production due to Anabaena coincided with high radiation, high temperature and the time of ice-break. Despite high biomass, production was low at other seasons. The interrelationship between chlorophyll-a, biomass production and turnover time of phytoplankton are also discussed. (Harris-Wisconsin)
W80-04664

COMPARATIVE CARBOHYDRATE STORAGE AND UTILIZATION PATTERNS IN THE SUBMERSED MACROPHYTES, MYRIOPHYLLUM SPICATUM AND VALLISNERIA AMERICANA,
Wisconsin Univ.-Madison. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W80-04665

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.
For primary bibliographic entry see Field 5B.
W80-04666

ACUTE TOXICITY OF RESIDUAL CHLORINE AND AMMONIA TO SOME NATIVE ILLINOIS FISHES,
Illinois State Water Survey, Urbana.
D. P. Roseboom, and D. L. Richey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170871, Price codes: A03 in paper copy, A01 in microfiche. Report of Investigation 85, 1977. 42 p, 10 Fig, 61 Ref, 5 Append.

Descriptors: *Chlorine, *Ammonia, *Illinois, *Water quality standards, *Water pollution effects, Water temperature, Freshwater fish, Bioassay, Toxicity, Mortality, Laboratory tests, Channel catfish, Bass, Sunfishes.

Ninety-six hour residual chlorine bioassays were conducted on bluegill and channel catfish. In 96-hour acute toxicity studies with ammonia (NH_3-N), bass in addition to bluegill and channel catfish, were included. The studies were performed in waters typical of most lakes and streams in midwestern states, i.e., relatively high in alkalinity and the salts of calcium and magnesium. Observations regarding the characteristics and reaction of the fishes to each toxicant were noted. For residual chlorine the 96-hour TL50s ranged from 0.18 to 0.33 mg/l for bluegill, depending on temperature and fish weight. For channel catfish the TL50 was about 0.09 mg/l; temperature was not a factor. For ammonia the 96-hour TL50s for bluegill were dependent on temperature and fish weight and varied from 0.40 to 1.3 mg/l. Size was not a factor for bass and channel catfish. Ninety-six hour TL50s for these fishes ranged from 0.72 mg/l at 22C to 1.2 mg/l at 30C for bass and 1.5 mg/l at 22C to 3.0 mg/l at 28C for channel catfish. For the protection of the fishes investigated, and consistent with the water pollution regulations of Illinois, residual chlorine in Illinois waters should not be detectable and NH_3-N should not exceed a concentration of 0.04 mg/l.
W80-04668

RESPONSE OF BIOLOGICAL REACTORS TO THE ADDITION OF POWERED ACTIVATED CARBON,
Connecticut Univ., Storrs. Dept. of Chemical Engineering.
D. W. Sundstrom, H. E. Klei, T. Tsui, and S. Nayar.
Water Research, Vol 13, p 1225-1231, 1979. 11 Fig, 5 Ref. OWRT A-057-CONN(2).

Descriptors: *Activated sludge, *Activated carbon, *Sewage treatment, Biological treatment, Phenols, Sludge treatment, Waste treatment, Water quality, Control, Sewage effluents, Municipal wastes, Industrial wastes.

A biological reactor operating on a synthetic feed was subjected to impulse and step disturbances of glucose and phenol. Powdered activated carbon was applied either as an impulse or as a step change to control reactor conditions. With glucose as the substrate, the addition of powdered carbon reduced the steady state TOC concentrations significantly but only slightly moderated the concentration transients after an upset. For impulse inputs of phenol, the simultaneous addition of carbon greatly reduced the magnitude of the transient changes in concentration. With step inputs of phenol, carbon addition rapidly lowered the phenol concentration in the reactor and permitted continuous operation with inlet phenol concentrations above 1000 mg/l. Thus, powdered carbon can provide an effective control method for maintaining effluent quality in the presence of toxic upsets. (Deal-EIS)
W80-04680

OXYGEN CONTENT AND TOXICITY FOR FISH OF SOME SUBSTANCES IN HEATED WATERS,
Institute of Meteorology and Water Management, Warsaw (Poland). Dept. of Water Economics.
For primary bibliographic entry see Field 5A.
W80-04681

LETHAL TEMPERATURES FOR FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
For primary bibliographic entry see Field 5A.
W80-04682

BEHAVIOUR OF FISH IN A THERMALLY DIFFERENTIATED ENVIRONMENT,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz, and B. Morawska.
Polish Ecological Studies, Vol 5, No 3, p 33-42, 1979. 5 Fig.

Descriptors: *Water temperature, *Thermal water, Electric power plants, *Fish behavior, Fish migration, *Fish physiology, Fresh water fish, Warm water fish, *Salmon, Atlantic salmon, *Preferred temperature, *Lethal temperature, Juvenile fish, Fish populations, *Vistula River(Poland), *Poland.

Discharge canals and heated zones are not totally abandoned by fish even at highest summer temperatures of water reaching 30-35C. Warm-water fishes form local populations adapted to elevated temperatures in the heated areas of water. Heated environments become areas of intensive reproduction of these fish species which in changed thermal, hydrological and morphological conditions of a water body find suitable conditions for spawning, that is a suitable substratum, flow, depth and temperature for spawning. Migratory salmonid fish do not acclimate to the high temperatures of discharge waters, and the ability to select cool currents makes it possible for these species to pass the heated areas of rivers and lakes even during the warmest periods. In comparing the above observations and the preferred temperatures of local species of fish laying between 9 and 28C, with the exception of salmonids, with predicted heating of waters, one can assume that for most fish species in the Vistula River, the temperatures of heated zone will be attractive, with the exception of the summer period with its low water level and temperatures exceeding 28.5C. Such temperatures were avoided by juveniles of three species, although adult individuals of two of these species and five other species were caught at higher temperatures reaching 33.5C. This does not by any means signify that such species will always occur in large numbers in discharge areas. (Katz-EIS)
W80-04683

FISH METABOLISM,
Institute of Applied Biology, Siedlce (Poland).
For primary bibliographic entry see Field 5A.
W80-04684

SEXUAL MATURITY OF FISH IN HEATED WATERS,
Wyzsza Szkola Rolnicza, Krakow (Poland). Inst. Zoologiczny Stosowanej.
P. Epler, and K. Bieniarz.
Polish Ecological Studies, Vol 5, No 3, p 52-63, 1979. 6 Fig, 3 Tab.

Descriptors: *Water pollution effects, *Fish physiology, *Fish behavior, Aquiculture, Growth, Fish reproduction, Fish eggs, Egg development, *Water temperature, Heated effluent, Thermal electric power, *Poland, *Vistula River(Poland), Fresh water fish, Premature spawning.

Increase in water temperature in the Vistula River will have the following undesireable effects on the reproduction of fish. These are premature spawning, and disturbed development of the fish eggs. The following favorable effects may be observed; the earlier spawning of many fish species, an increase in the number of spawnings and a prolongation of the spawning period. The authors feel that in the Vistula River the unfavorable changes will be balanced by favorable changes although not always in the same species. (Katz-EIS)
W80-04685

SPAWNING OF FISH AND THEIR EMBRYONIC AND LARVAL DEVELOPMENT,
Wroclaw Univ. (Poland). Muzeum Zoologiczny.
B. Kokurewicz.
Polish Ecological Studies, Vol 5, No 3, p 64-71, 1979. 3 Fig.

Descriptors: *Fish physiology, *Fish behavior, *Fish reproduction, Water pollution effects, *Water temperature, Thermal pollution, Thermal power, *Thermal power plants, Aquiculture, Spawning periods, Heated environments, Fish eggs, Fresh water fish, *Vistula River(Poland), *Poland.

Comparison of spawning periods of fish in natural waters with changes taking place in heated environments allows for assuming the following conclusions. Spawning in heated zones will take place earlier and at optimal temperatures or temperatures tolerated for embryonic development (perch, pike-perch, roach). One other possibility is an earlier spawning and prolonging the period of reproduction by increasing the number of batches (tench, bleak, bream). Danger to the reproduction of phytophilus fish in heater environments is not caused by temperature increase, but by the lack of spawning grounds. The latter can be destroyed a result of regulating and embanking the river, or due to the fact that temperature increase precedes spring rising of waters. Fish may be ready to spawn earlier and as result of the lack of suitable spawning grounds (for example on areas flooded later) depositing of spawn can be retarded. Similarly as spawning, embryonic development should likewise take place within the range of optimal temperatures, that is increasing gradually from mid-February to the end of June from 10 to 24C. Fish species such as the bleak, rudd, tench, commencing multi-batch spawning in warm waters can meet with high temperatures of over 28C in July and August, that is unfavorable for reproduction toward the end of the reproducing period, especially at low water levels. Reducing the period of embryonic development can be favorable providing temperature increase will remain within the range of temperatures optimal for the development of a given fish species. (Katz-EIS)
W80-04686

FEEDING OF FISH AND THEIR FEEDING GROUNDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
For primary bibliographic entry see Field 5A.
W80-04687

GROWTH OF FISH IN HEATED ENVIRONMENTS,
Instytut Rybactwa Srodladowego, Olsztyn-Kortowo (Poland). Dept. of Ichthyology.
H. Wilkonska.
Polish Ecological Studies, Vol 5, No 3, p 80-85, 1979. 2 Fig.

Descriptors: *Fresh water fish, *Fish growth, *Vistula River(Poland), *Poland, *Cooling water, Juvenile fish, Adult fish, *Thermal effluents, Perch, Fisheries, Water temperatures, Water pollution Effects, Thermal power plant, Low water flow.

Heating of the Vistula River will result in an increased growth rate of juveniles of most species occurring in the heated area. Predicted increase of temperature above 28C in case of low water flow (June, July, August) can inhibit the growth of fish, and should be lowered by proper changes of power plant performance. Although warm-water species form local populations in heated zones, no significant changes are to be expected with respect to growth rate of adult fish in the Vistula, this being due to stream-like discharge of heated effluents and its rapid cooling along a short stretch (no more than a few hundred meters) of the river. (Katz-EIS)
W80-04688

TEMPERATURE CHANGES AND FISH DISEASES,
Instytut Rybactwa Srodladowego, Piaseczno (Poland). Dept. of Fish Culture.
B. Pietrzak.
Polish Ecological Studies, Vol 5, No 3, p 86-94, 1979. 1 Fig, 3 Tab.

Descriptors: *Fish diseases, *Fish parasites, *Fish physiology, Fish behavior, Water pollution effects, Thermal power plants, Cooling waters, *Water temperature, Fish pathogen, Immunological responses, Bacteria, Virus, Thermal optimum, Fish parasites.

Changes of one environmental factor, in this case temperature, which favor the development of some pathogens and inhibit others, do not necessarily mean that certain fish diseases will occur, and other - disappear. It is worth to repeat after Snieszko (1974) that a disease occurs when there is a virulent pathogen, a susceptible host (i.e. fish), and proper environmental conditions. Temperature, although important, constitutes only one of many environmental factors. Our predictions, based on only scarce data, should be treated rather as a warning; they point to some possibilities, but there are no bases for assuming that these or other diseases and parasite invasions will occur after heating of the river. Predicted temperatures of the Vistula River affected by heated effluents will create conditions favouring immunological processes in cyprinids. At the same time bacteria will find favourable thermal conditions over a prolonged period. In case of viral diseases, their thermal optima will last two months longer than in natural environments. It is also possible that invasions of parasites will be intensified. (Katz-EIS)
W80-04689

CHANGES OF FISH COMMUNITIES IN HEATED ENVIRONMENTS,
Instytut Rybactwa Srodladowego, Warsaw (Poland). Heated Waters Lab.
L. Horoszewicz.
Polish Ecological Studies, Vol 5, No 3, p 95-99, 1979. 1 Fig.

Descriptors: *Water pollution effects, *Fish populations, *Fish reproduction, Fish behavior, Fish migration, *Vistula River(Poland), *Poland, Cooling water, Discharge channels, Fresh water fish, Reservoirs, Fish fauna, Aquatic plants.

Comparison of the trends taking place in fish communities in different reservoirs in a variety of environments quite clearly points to species capable of invading or at least of maintaining their dominance in heated environments of the temperate climatic zone, now matter how differentiated. Beginning from the most plastic and vigorous ones, these species can be arranged as follows: bleak, roach, bream, and white bream. Two other species - rudd and chub - are common components of fish fauna in heated waters, but they exclude each other as dominants. Most frequently, predomination of one of them is determined by flow rate, and thus by amount and type of submerged water vegetation. This statement is supported by chub catches at mouths of discharge canals in both water bodies under study (Ivankovskoe and Kucurgan), as well as by visible increase of chub numbers in Lichenskie and Slesinskie lakes in the last 3 years of studies i.e. after the introduction of safety cooling system. As regards predatory species, perch is most frequently found in heated waters whereas pike disappears. Some increase of crucian carp, tench, carp, and pike-perch may be noted in water bodies with abundant vegetation, and of bass and bullhead catfish in heated flowing waters. Response of undermouth and barbel is still unclear. It is probable that both species periodically migrate from cool to heated parts. There are on data sufficient for predicting the responses of other not abundant and sporadically occurring fish species. (Katz-EIS)
W80-04690

THE IMPACT ON ICHTHYOFAUNA AND POSSIBLE CONTROL OF THE EFFECTS OF THERMAL DISCHARGE,
Instytut Rybactwa Srodladowego, Piaseczno (Poland).
For primary bibliographic entry see Field 5A.
W80-04691

ACCUMULATION OF 210PB IN FRESHWATER PLANTS,
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
For primary bibliographic entry see Field 5B.
W80-04692

EFFECTS OF SEAWATER SUSPENSIONS OF IRON ORE DUST ON FUCUS OOSPHERES,
Glagow Univ. (Scotland). Dept. of Botany.
A. D. Boney.
Marine Pollution Bulletin, Vol 11, p 41-43, 1980. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Marine algae, *Iron, *Inhibition, *Reproduction, Physiology, Water chemistry, Metals, Suspended solids, Mode of action, Particle size, *Fucus, Bioassay.

When shaken in ore dust suspensions and when made to sink through ore dust suspensions in water columns, freshly liberated Fucus oospheres (eggs) act as centers for the buildup of dust particle aggregates. Dust laden oospheres are less efficient as attractants of spermatozoids. The amounts of dust-'loading' of the eggs depends on the initial sizes of the djust particle aggregates form in seawater. (Deal-EIS)
W80-04693

THE EFFECTS OF MERCURY EXPOSURE ON INTRACELLULAR DISTRIBUTION OF MERCURY, COPPER AND ZINC IN SKELETONEMA COSTATUM (GREV.) CLEVE,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W80-04695

UPTAKE AND ELIMINATION OF ANTIMONY IN THE MUSSEL, MYTILUS EDULIS,
Institute fuer Meeresforschung, Bremerhaven (Germany, F.R.).
F. Walz.
Veroffentlichungen des Institut fur Meeresforschung in Bremerhaven, Vol 18, p 203-215, 1979. 4 Fig, 1 Tab, 23 Ref.

Descriptors: *Metals, *Absorption, *Mussels, *Toxicity, Mortality, Mode of Action, Chemical properties, Path of pollutants, Mathematical models, Animal physiology, Animal metabolism, Animal growth, *Antimony, *Tissue analysis, *Bioaccumulation, *Depuration.

In experiments of 186 days, antimony (as antimonyl-tartrate) showed no toxic effects up to concentrations (nominal) of 5 mg Sb/l. At 10 mg Sb/l some mortality occurred, and shell deformations. 17-20 mm Mytilus edulis accumulate antimony from sea water with concentration factors (on the basis of dry weight of total tissues) of 59-103, higher values at concentration 5 mg Sb/l, lower values at 0.15 mg Sb/l. Uptake is more or less linear during the initial phase of experiments (about 30 days) until steady state conditions are reached. In elimination experiments biological half life time is 17.8 days, regardless of initial concentrations in tissues. The monocompartment model of Ruzic is an imperfect description of uptake kinetics; probably a multicompartment model is needed. (Deal-EIS)
W80-04697

THE CONTENT OF CERTAIN METALS IN THE SOFT TISSUES OF THE BIVALVE MOLLUSKS TRIDACNA SQUAMOSA FROM ISLANDS OF THE TROPICAL ZONE OF THE PACIFIC OCEAN IN CONNECTION WITH ENVIRONMENTAL CONDITIONS,
Akademiya Nauk SSSR, Vladivostok. Lab. of Geochemistry.
N. K. Khristoforova, N. N. Bogdanova, and A. I. Obukhov.
The Soviet Journal of Marine Biology, Vol 5, No 3, p 217-222, 1979. 1 Fig, 4 Tab, 7 Ref.

Descriptors: *Heavy metals, *Mollusks, *Pacific Ocean, Iron, Manganese, Copper, Zinc, Lead, Benthic fauna, Littoral, Bottom sediments, Geochemistry, Geomorphology, Pacific Ocean, Bagaman Island, *Tissue analysis, *Tridacna.

The content of the heavy metals Fe, Mn, Cu, Zn, and Pb in the soft tissues of Tridacna inhabiting the inshore waters of islands of early origin is determined. It is shown that the trace element composition of mollusk tissues depends on the geomorphology of the islands, chemical composition of the substrate, content of metals in the water, and the dynamics of the water masses. In spite of the constant chemical composition of oceanic waters and the apparent uniformity of environmental conditions, the inshore zones of different islands are individual in their combination of hydrogeochemical parameters, which is reflected in the tissue composition of the mollusks. (Deal-EIS)
W80-04698

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-04699

TOXICITY OF BUTOXYETHYL ESTER OF 2,4-D TO SELECTED SALMON AND TROUT,
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).
For primary bibliographic entry see Field 5A.
W80-04700

VARIABLES AFFECTING BODY BURDENS OF LEAD, ZINC AND CADMIUM IN A ROADSIDE POPULATION OF THE SNAIL CEPAEA HORTENSIS MULLER,
Durham Univ. (England). Dept. of Zoology.
P. Williamson.
Oecologia (Berl.), Vol 44, p 213-220, 1980. 3 Fig, 3 Tab, 76 Ref.

Descriptors: *Lead, *Zinc, *Cadmium, *Snails, Heavy metals, Path of pollutants, *Animal physiology, Animal metabolism, Regression analysis, Animal populations, Seasonal, Chemical properties, *Tissue analysis, *Bioaccumulation.

Application of multiple regression analysis to the lead, zinc and cadmium contents of 985 Cepaea hortensis collected from a suburban roadside site over two years showed that body weight, age and daylength were the major factors affecting soft tissue body burdens. Other highly significant influences were physiological changes at the juvenile-adult transition, vapour pressure deficit for the two days before sampling, and mean rainfall for the ten days before. Together these factors accounted for 69%, 79% and 87% of the total variance in lead, zinc and cadmium body burdens respectively. Unexplained variance was provisionally ascribed to individual differences in recent diet and digestive activity. The digestive gland contained the majority of the total body burden of each metal and played an important role in lead and zinc elimination. Whereas levels of lead in C. hortensis fluctuated rapidly, zinc was exchanged more slowly, perhaps by active regulation, and cadmium was effectively immobile, accumulating progressively with age. The implications of these results to the predators of land snails, and to terrestrial monitoring programmes, are discussed. (Deal-EIS)
W80-04702

OIL POLLUTION AND SEABIRDS: ATLANTIC CANADA 1976-77 AND SOME IMPLICATIONS FOR NORTHERN ENVIRONMENTS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Dept. of Fisheries and Oceans.
E. M. Levy.
Marine Pollution Bulletin, Vol 11, p 51-56, 1980. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Oil spills, *Birds, *Mortality, Canada, Atlantic Ocean, Oil, Oil pollution, Fuels, Mode of action, Arctic, Animal physiology, Chemical analysis, Gas chromatography.

Chemical analyses of the oils on dead or moribund seabirds from Atlantic Canada during the winter of 1976-77 indicated that some of the birds were contaminated with oil spilled by the Argo Merchant grounding, some by oil probably from the Grand Zenith sinking, and still others by oil from various small local spills of unknown origin. These victims demonstrated that an extremely minute oiling may lead to the death of a seabird when the effects of the oil are synergistically combined with the stresses imposed by severe environmental conditions. This may intensify the impact of oil in the Arctic and thereby have a profound effect on seabird populations. (Deal-EIS)
W80-04705

POLYCHLORINATED BIPHENYLS AND OTHER ORGANIC CHEMICAL RESIDUES IN FISH FROM MAJOR WATERSHEDS OF THE UNITED STATES, 1976,
Environmental Research Lab.-Duluth, MN.
G. D. Veith, D. W. Kuehl, E. N. Leonard, F. A. Puglisi, and A. E. Lemke.
Pesticides Monitoring Journal, Vol 13, No 1, p 1-11, 1979. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Polychlorinated biphenyls, *Water quality standards, *Freshwater fish, *Pesticide residues, DDT, Chlorinated hydrocarbon pesticides, Phenols, Chemical analysis, Gas chromatography, Watersheds(Basins), Chlorinated benzenes, Styrenes, Anisoles, *Tissue analysis, *Bioaccumulation, *HCB, *Chlordane, Phenols, Anilines, Propanes, Butadiene, Petroleum hydrocarbons.

Composite samples of fish were collected from major United States watersheds in 1976 and analyzed for PCBs and related organic chemicals. PCBs were found in 93 percent of the fish samples; 53 percent of the samples contained more than 5 ppm PCBs, whole fish basis, which is the current tolerance level set by the U.S. Food and Drug Administration. Only 14 percent of the samples contained less than the proposed action level of 2 ppm PCBs. PCB concentrations ranged from less than 0.3 ppm to 140 ppm in the composite samples. Sigma DDT concentrations ranged from less than 0.05 ppm to 4.53 ppm. Hexachlorobenzene was identified in 19 percent of the samples, and chlordane components were identified in 36 percent of the samples. Chemicals identified by gas chromatography/mass spectrometry but not quantified include chlorinated benzenes, styrenes, anisoles, phenols, anilines, propanes, and butadienes, as well as mixtures of petroleum hydrocarbons. (Deal-EIS)
W80-04706

EFFECTS OF URBAN RUNOFF AND TREATED MUNICIPAL WASTEWATER ON A MANMADE CHANNEL IN NORTHEASTERN ILLINOIS,
Metropolitan Sanitary District of Greater Chicago, IL.
I. Polls, C. Lue-Hing, D. R. Zenz, and S. J. Sedita.
Water Research, Vol 14, p 207-215, 1980. 7 Fig, 6 Tab, 17 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Biological communities, Municipal wastes, Water quality, Sewage treatment, Runoff, Benthic fauna, Isopods, Oligochaetes, Diptera, Nutrients, Ammonia, Nitrogen, Phosphorus, Water chemistry, Illinois, Chicago River, North Shore Channel(Northeastern Ill).

The benthic macroinvertebrates and water quality were sampled monthly at five locations in the North Shore Channel (northeastern Illinois) from January through November 1973. Secondary treated effluent enters the channel from the Northside Sewage Treatment Plant, 5.4 km above its junction with the North Branch of the Chicago River. Street and combined sewer overflows located above and below the treatment plant outfall discharge to the channel only during storm events. Compared to a biological survey conducted by the U. S. Public Health Service 12 years prior, the present study revealed that the most important change in the benthic faunal composition downstream from the Northside Plant final effluent outfall was the appearance of large numbers of midges and isopods, suggesting improvement in water quality. In 1961, the fauna was composed principally of pollution tolerant oligochaetes. The 1973 study showed that the water quality in the channel was markedly influenced by a combination of both urban runoff and a point source effluent from the Northside Sewage Treatment Plant. Mean concentrations of ammonium nitrogen, nitrite-nitrate nitrogen, total phosphorus and conductivity increased significantly downstream from the treatment plant outfall compared to values upstream. (Deal-EIS)
W80-04710

THREE TYPES OF SKIN PAPILLOMAS OF FLATFISHES AND THEIR CAUSES,
Hamburg Univ. (Germany, F.R.). Zoologisches Inst.
For primary bibliographic entry see Field 5A.
W80-04713

EFFECTS ON RAINBOW TROUT (SALMO GAIRDNERI) OF A CHRONIC EXPOSURE TO WATERBORNE SELENIUM,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Lab.
For primary bibliographic entry see Field 5B.
W80-04714

INFLUENCE OF SECONDARILY TREATED KRAFT MILL EFFLUENT ON THE ACCUMULATION RATE OF ATTACHED ALGAE IN EXPERIMENTAL CONTINUOUS-FLOW TROUGHS,
Weyerhauser Co., Tacoma, WA. Environmental Technology Dept.
M. L. Bothwell, and J. G. Stockner.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, p 248-254, 1980. 5 Tab, 31 Ref.

Descriptors: *Pulp wastes, *Toxicity, *Diatoms, Aquatic algae, Growth rates, Seasonal, Inhibition, Pulp and paper industry, Nutrients, Nitrogen, Ammonia, Periphyton, Nitrates, Nitrites, Kraft mill effluent, Bioassay.

In three seasonal experiments in 1977, increases in the rate of attached algal accumulation were normally found with each additional increment of secondarily treated kraft mill effluent (KME). The effect of KME on the instantaneous accumulation coefficients of algae were 1.2-2.8 times greater in the summer than in the autumn or spring at all dilutions tested. At higher concentrations (5 and 25% v/v KME) an inhibition of accumulation was usually observed during the first 5-6 d of exposure; after this period diatom biomass increased sharply. Succession of diatom taxa to different forms, rather than physiological adaptation by usually predominant species occurred. No inhibition was noted at lower concentrations (0.5, 1, and 2% v/v) of KME. Relatively high levels (20-30 microg/l) of soluble reactive phosphorus (SRP) and low concentrations of nitrate + nitrite-nitrogen (5-10 microg/l) and ammonia-nitrogen (2-20 microg/l) in the river dilution water suggested that nitrogen was the primary limiting nutrient. Ammonium uptake tests for nitrogen deficiency confirmed nitrogen limitation in algae grown in unenriched river water compared to algae exposed to KME for 6 d. Differences in chlorophyll a: ATP ratios among periphyton communities of the different treatments were minimal after 9 d. (Deal-EIS)
W80-04715

ZOOPLANKTON AS AN INDICATOR OF POLLUTION OF RESERVOIRS,
Tagliatti Hydrometeorological Observatory (USSR).
N. A. Dzyuban, and S. P. Kuznetsova.
Hydrobiological Journal, Vol 14, No 6, p 35-39, 1978. 1 Fig, 21 Ref.

Descriptors: *Bioindicators, *Zooplankton, *Water quality, *Reservoirs, Trophic level, Monitoring, Dominant organisms, Mathematical models, Statistical analysis, Biological communities, Water pollution effects, *Species diversity, *Diversity indices.

This article describes the first data on biomonitoring by the network of the USSR Hydrometeorological Service, and new patterns of response of zooplankters to pollution under reservoir conditions are defined. Zooplankters are a fairly representative indicator of the saprobic state of reservoir water quality. Polluted zones are determined on the basis of saprobic indices, species distribution in the zooplankton, and variations of zooplankter abundance, which tend to reflect sensitivity to pollution. The substitution, in the Pantle-Buck equation, of the quantity h (which expreses the nominal abundance of a species) by the quantity n (its actual abundance in the sample) eliminates the subjectivity of the nominal estimate. (Deal-EIS)
W80-04716

ACUTE RESIDUAL TOXICITY OF SEVERAL DISINFECTANTS IN DOMESTIC AND INDUSTRIAL WASTE WATER,
Grand Valley State Colleges, Allendale, MI. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-04717

EFFECTS OF AMMONIA AND AMMONIUM ON TOLERANCE AND BYSSOGENESIS IN PERNA VIRIDIS,
Fisheries Coll., Mangalore (India).
N. A. Reddy, and N. R. Menon.
Marine Ecology-Progress Series, Vol 1, p 315-321, 1979. 7 Fig, 7 Tab, 11 Ref.

Descriptors: *Toxicity, *Mussels, *Ammonia, Ammonium compounds, Lethal limit, Mortality, Bioassay, Animal pathology, Animal physiology, Growth rates, Nitrogen compounds, Water chemistry, Hydrogen ion concentration, *Perna.

Individuals of the commercially important green mussel Perna viridis were exposed to different concentrations of ammonia (NH3) and ammonium (NH+4), to determine their reactions with reference to tolerance and byssogenesis. Eight concentrations of ammonia, ranging from 2.75 to 33.00 mg/l, and 7 concentrations of ammonium, ranging from 5.00 to 75.00 mg/l, were tested. Young individuals in the size range 20 to 24 mm shell length, collected from an unpolluted rocky shore, were used as test organisms. The 96-h lethal concentration causing 50% mortality (LC 50) was 7.60 mg/l for NH3 and 13.00 mg/l for NH+4. For ammonia, the difference between LC 50 values at 48 and at 96 h is drastic. In sublethal concentrations P. viridis retarded or suspended pedal-gland activity. A sharp reduction in the number of threads produced occurs at 5.50 and 8.25 mg/l of ammonia. At higher concentrations the byssus threads secreted displayed reduced rates of tanning and hardening. The difference in the number of byssus threads produced at various ammonia concentration was highly significant. Compared to controls the discs developed at the tips of the byssus threads did not possess normal adhesive properties. (Deal-EIS)
W80-04721

ACUTE TOXICITY OF HEAVY METALS TO AQUATIC INVERTEBRATES AT DIFFERENT TEMPERATURES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-04723

A COMPARISON OF TOLERANCE TO PHENOL EXHIBITED BY AQUATIC INSECTS AND ARACHNIDA DURING ONTOGENESIS,
Institute of Ecological Toxicology, Baykal (USSR).
V. A. Alekseyev.
Hydrobiological Journal, Vol 14, No 6, p 83-89, 1978. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Phenols, *Toxicity, *Aquatic insects, *Diptera, Bioassay, Growth stages, Reproduction, Larval growth stages, Animal growth, Mode of action, Water chemistry, Mortality, Animal physiology, *Arachnida.

The effect of phenol on reproduction and development of water insects and Arachnida is traced. Resistance was studied in 23 species at different stages of metamorphosis. Small concentrations of phenol to stimulate reproduction and development (the order of oviposition is more distinct, larvae and imago hatching is more complete even as compared with the control, periods of metamorphosis are shortened): in more toxic solutions oviposition is irregular, periods of oviposition and larvae and imago hatching become longer. When concentrations are high, the loss of eggs and subsequent stages increases. Resistance at different stages of ontogenesis is shown to be determined by morphology, behavior and ecology. (Deal-EIS)
W80-04724

ZOOPLANKTON ECOLOGY AND POLLUTION STUDIES,
Polytechnic of the South Bank, London (England). Dept. of Applied Biology.
M. P. Tevlin, and M. J. Burgis.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 19-38, 1978. 8 Fig, 108 Ref.

Descriptors: *Zooplankton, *Bioindicators, *Daphnia, Food webs, Crustaceans, Water quality standards, Water chemistry, Bioassay, Toxicity, Methodology, Monitoring, Growth rates, Animal physiology, Cadmium.

Zooplankton organisms occupy a central position in the food webs of aquatic ecosystems. This, plus their sensitivity to environmental factors, both natural and artificial, makes the Cladocera, particularly species of Daphnia, of considerable significance to pollution studies. They are especially useful in the detection of low levels of toxins and this is illustrated by a brief outline of the historical development of pollution studies using biological indicators. Since the effects of pollutants on these organisms can only be assessed when the effects of natural environmental variation are taken into account, the complexities of natural population responses to environmental factors are reviewed. Pollution effects are discussed with reference to studies involving natural communities and laboratory assay procedures. (Deal-EIS)
W80-04725

SYSTEMS OF BIOLOGICAL INDICATORS FOR WATER QUALITY ASSESSMENT,
Laboratory for Biological Research in Aquatic Pollution, Ghent (Belgium).
G. Persoone, and N. DePauw.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 39-75, 1978. 13 Fig, 9 Tab, 53 Ref.

Descriptors: *Bioindicators, *Water quality, *Methodology, Monitoring, Water quality control, Water quality standards, Trophic level, Productivity, Biological communities, Aquatic populations, Dominant organisms, Oligotrophy, Mesotrophy, Statistical analysis, *Species diversity, *Diversity indices.

The paper reviews and comments on the major methods which have been worked out at the international level for the assessment of the quality of surface waters with the aid of biological-ecological criteria. The endeavours of the Commission of the European Economic Communities aiming at the intercalibration of methods used in different countries, and the trends which emerged from recent exercises carried out in different hydrographic basins are outlined briefly. (Deal-EIS)
W80-04727

ACIDITY AND SPECIES DIVERSITY IN FRESHWATER CRUSTACEAN FAUNAS,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 5A.
W80-04731

A COMPARISON OF POPULATIONS OF THE ISOPOD ASELLUS AQUATICUS ABOVE AND BELOW POWER STATIONS IN ORGANICALLY POLLUTED REACHES OF THE RIVER TRENT,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
R. J. Aston, and A. G. P. Milner.
Freshwater Biology, Vol 10, p 1-14, 1980. 7 Fig, 5 Tab, 14 Ref.

Descriptors: *Isopods, *Powerplants, *Toxicity, *Aquatic populations, Water temperature, Life history studies, Invertebrates, Biomass, Heated water, Thermal pollution, Seasonal, Growth stages, River Trent, Water pollution effects.

Five populations of Asellus aquaticus, subjected to different combinations of temperature and organic pollution in the River Trent, were examined over a period of 18 months. The life-cycle was probably completed in a year or less in all the populations sampled, a larger proportion of the animals completing the life-cycle in less than a year at warmer locations. Young animals also hatched 1 or 2 months earlier at the warmer locations. At the locations subjected to most organic pollution, population densities and the size of animals of both sexes were the largest. The size of ovigerous females, however, appeared to be inversely related to temperature, the smallest occurring at the warmest location. Possible explanations for these differences are given in terms of the amount of food available and the effect of temperature on growth and sexual maturation. (Deal-EIS)
W80-04732

OSMOTIC RESPONSES OF EGGS AND LARVAE OF THE PACIFIC HERRING TO SALINITY AND CADMIUM,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5B.
W80-04733

RADIOACTIVE CONTAMINATION OF THE AQUATIC FOOD-CHAIN AND CONSEQUENT RISK TO MAN,
Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Div. Protezione Ambiente.
A. A. Cigna.
In: Biological Aspects of Freshwater Pollution, O. Ravera, Ed., Pergamon Press, p 163-177, 1978. 2 Ref.

Descriptors: *Food chains, *Public health, *Radioisotopes, Radiation, Radioactivity effects, Radioecology, Radiosensitivity, Radiochemical analysis, Chemical properties, Sedimentation, Path of pollutants, Water quality standards, Radioactive wastes.

The extreme caution adopted to keep any radioactive contamination within safe and severe limits implies that any component of the environment is protected from possible harmful effects, considering that man is among the organisms most sensitive to radiation. The general criteria of radiation protection lead to the fixation of the quantity of radioactive substances which can be discharged into an environment. This quantity is usually expressed in a so called 'discharge formula'. Many difficult problems are involved in the determination of such a formula: characteristics of environmental media, various phenomena which may modify the distribution of radioactivity and all factors which influence the exposure of man to radiation. All these factors must be evaluated against the general re-

quirement of public health and of economical feasibility. Only a fraction of the limiting environmental capacities will eventually be utilized for the effective discharge of radioactive wastes into the environment. Within this fraction the contribution of each radionuclide species is defined relative to the contribution of all other species. (Deal-EIS)
W80-04734

THE EFFECTS OF ACCLIMATION ON THE SALINITY TOLERANCE OF GRASS CARP, CTENOPHARYNGODON IDELLA (CUV. AND VAL.),
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, and A. Zdinak.
Journal of Fish Biology, Vol 16, p 171-175, 1980. 3 Tab, 9 Ref.

Descriptors: *Salt tolerance, *Carp, *Adaptation, Grass carp, Salinity, Water chemistry, Fish physiology, Animal metabolism, Toxicity, Mortality, Freshwater fish, Lethal limit, Weight, Ctenopharyngodon, *Acclimation, Salinity tolerance.

Grass carp acclimated to 3, 5, 7, and 9 o/oo salinities were tested for salinity tolerance. The upper tolerance limit (LS50) for 3 and 5 o/oo, and 7 o/oo acclimated fish were 14.2 and 14.0 o/oo, respectively. Fish acclimated to 9 o/oo had a 50% mortality at an estimated salinity of 16.0%, for 24h exposure. Weight losses for the 3 and 5 o/oo acclimated fish were significantly lower than for those acclimated to 9 o/oo. (Deal-EIS)
W80-04735

CADMIUM TOXICITY TO THREE SPECIES OF ESTUARINE INVERTEBRATES,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-04736

THE COMBINED EFFECT OF SALINITY, TEMPERATURE AND OIL ON THE GROWTH PATTERN OF EMBRYOS OF THE KILLIFISH, FUNDULUS HETEROCLITUS WALBAUM,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-04737

LIVER CADMIUM UPTAKE, CATALASE INHIBITION AND CADMIUM THIONEIN PRODUCTION IN THE KILLIFISH (FUNDULUS HETEROCLITUS) INDUCED BY EXPERIMENTAL CADMIUM EXPOSURE,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-04738

KEPONE EFFECTS ON LARVAL DEVELOPMENT OF MUD-CRAB AND BLUE-CRAB,
Duke Univ., Durham, NC. Dept. of Zoology.
C. G. Bookhout, J. D. Costlow, Jr., and R. Monroe.
Water, Air, and Soil Pollution, Vol 13, p 57-77, 1980. 7 Fig, 6 Tab, 27 Ref.

Descriptors: *Pesticide toxicity, *Larval growth stage, *Crabs, Mortality, Lethal limit, Bioassay, Growth stages, Chlorinated hydrocarbon pesticides, Growth rates, Crustaceans, *Kepone.

Laboratory experiments were conducted to determine the effects of Kepone on the larval development of the mud-crab, Rhithropanopeus harrisii, and the commercial blue crab, Callinectes sapidus, from the time of hatching until the first crab stage was reached. Differential survival of R. harrisii from hatching to first crab stage occurred in a range of 35 to 125 ppb Kepone, whereas differential survival of C. sapidus over the same period of development occurred in a range of 0.1 to 1.0 ppb. Statistical analysis indicated that, for every 10 ppb Kepone added, duration from hatching to first crab stage of R. harrisii was increased by 0.391 + or - 0.043 days; whereas for each increase of 0.1 ppb, the duration from hatching to first crab stage of C. sapidus is prolonged by 0.38 + or - 0.10 days. The first and second zoeal stages of R. harrisii were the most sensitive developmental stages to Kepone, but the first zoeal stage of C. sapidus was not sensitive, statistically, to any concentration of Kepone tested. In zoeal stages II, III and IV, there were significant increases in mortality of C. sapidus over the previous stage in all media tested. (Deal-EIS)
W80-04739

A MARINE ALGAL BIOASSAY METHOD: RESULTS WITH PESTICIDES AND INDUSTRIAL WASTES,
Environmental Research Labs., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-04740

THE USE OF ISAZA (CHAENOGOBIUS ISAZA TANAKA) TO STUDY THE PCB POLLUTION (IN JAPANESE),
Kobe Shoka Daigaku (Japan).
N. Watanabe, Y. Ishimaru, N. Ishida, Y. Katayama, and S. Kitayama.
The Japanese Journal of Limnology, Vol 40, No 2, p 66-73, 1979. 6 Fig, 1 Tab, 16 Ref. (English abstract).

Descriptors: *Polychlorinated biphenyls, *Pesticide residues, *Chemical wastes, Industrial wastes, Chemical analysis, Gas chromatography, Animal metabolism, Lakes, Lipids, Pesticide kinetics, Lake Biwa, Japan, Chaenogobins, *Japan, *Tissue analysis.

Polychlorinated biphenyls (PCBs) have been used in industry since 1954. Around Lake Biwa, 16 factories used such materials, and they were detected in many environmental samples from the lake. In this study, the PCB concentration was determined by gas-chromatography in Isaza, in the northern part of Lake Biwa. PCB residues were found in all the samples collected from 1966 to 1976, and the concentrations ranged from 0.413 to 1.53 ppm. PCB residues in Isaza aged 1 are higher than those in Isaza aged 0, and the differences is significant. This difference is thought to be related to the difference of their fat contents. The ratio of highly chlorinated PCB to the total PCB residue in Isaza aged 1 is significantly higher than that in Isaza aged 0. The reason seems to be that low chlorinated PCBs are more easily metabolized than highly chlorinated PCBs. PCB residues in Isaza do not show much decrease even after PCB production was stopped in 1972. (Deal-EIS)
W80-04741

CHLOROTIC DEATH OF LEMNA GIBBA BY CADMIUM IN DIFFERENT CONCENTRATIONS OF NUTRITIONAL MINERALS (IN JAPANESE),
Tokyo Univ. of Agriculture and Technology (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5A.
W80-04742

RESPONSES OF SALT MARSH VEGETATION TO OIL SPILLS AND REFINERY EFFLUENTS,
Field Studies Council, Pembroke (Wales). Oil Pollution Research Unit.
J. M. Baker.
In: Ecological Processes in Coastal Environments, R. L. Jefferies and A. J. Davy, Eds., Blackwell Scientific Publications, Oxford, p 529-542, 1977. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Oil spills, *Toxicity, *Salt marshes, *Aquatic plants, Oil, Oil pollution, Plant physiology, Mode of action, Plant pathology, Plant populations, Dominant organisms, Plant growth, Salt marsh plants, *Crude oil.

Salt marsh plants show a wide range of susceptibility to typical crude oils, ranging from annuals such as Salicornia spp. which are killed by one oiling, to Oenanthe lachenalii which withstands 12 successive monthly applications of fresh Kuwait crude oil. Spartina anglica survives most single oil spillages well but does not tolerate chronic pollution. Experimental evidence suggests that oil inteferes with the normal oxygen diffusion process down the plants into the roots. Competitive advantages are gained by tolerant species following oiling. This is particularly striking in the upper salt marsh community studied, where the susceptible Juncus maritimus was replaced by Oenanthe and by Agrostis stolonifera. Marsh cleaning methods (burning, cutting or treatment with chemical dispersants) do not appear to decrease the damage done by oil pollution, and often increase it. Different crude oils and products vary considerably in their toxicity. Light aromatics appear to be the greatest contributor to acute toxicity. Some heavy or weathered oils stimulate the growth of salt marsh plants. (Deal-EIS)
W80-04743

PREDICTED CORROSION AND SCALE-FORMATION PROPERTIES OF GEOPRESSURED GEOTHERMAL WATERS FROM THE NORTHERN GULF OF MEXICO BASIN,
For primary bibliographic entry see Field 2K.
W80-04766

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978: BALANCING ENERGY NEEDS WITH ENVIRONMENTAL CONCERNS,
For primary bibliographic entry see Field 6E.
W80-04793

5D. Waste Treatment Processes

PHOSPHATE REMOVAL FROM INDUSTRIAL AND MUNICIPAL WASTEWATER,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
R. C. Ahlert, M. L. Granstrom, and M. A. Slam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173958, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute, Rutgers University, Final Technical Completion Report, April 1980. 7 p. OWRT-A-052-NJ(1), 14-34-0001-9032.

Descriptors: *Phosphorus, Phosphates, Treatment, Waste water treatment, Industrial wastes, Municipal wastes, Evaluation, Methodology, Chemical precipitation, Nutrients, Sewage treatment, Phosphorus removal.

Phosphorus removal was evaluated at several points in a conventional wastewater treatment process. Samples were taken from a secondary plant utilizing a high rate trickling filter on municipal wastewater. Treatment of settled primary effluent, secondary effluent and settled secondary effluent was considered. The experimental matrix included ferric ion dosage and pH level. Sampling points were selected to highlight process variables of interest. These included organic carbon content and unsettled solids content. In all cases, phosphorus removal was substantially less than predicted from pure species solubility data. In addition, the effect of unsettled or unsettleable solids is marked. In all experiments, comparisons of removal efficiency were made for filtered and unfiltered portions of process samples. Beyond the obvious effects of cation dosage and pH, the nature and concentration of particulate matter appear to be important treatment variables.
W80-04543

WATER INTAKE, WASTEWATER PRODUCTION AND TREATMENT, AND AIR POLLUTION CONTROL IN COAL-FIRED STEAM-ELECTRIC POWER GENERATING STATIONS.
CH2M/Hill Ltd., Ottawa (Ontario).
Water Pollution Control Directorate, Ottawa, Ontario, Canada, Environmental Protection Service. Report No EPS 3-WP-80-1, 1980. 145 p, 32 Fig, 33 Tab, 29 Ref.

Descriptors: *Baseline studies, *Emission standards, *Air pollution, *Water pollution, Particulate removal, Flue gas desulphurization, Solid waste disposal, Water management, Costs, Waste disposal, Power plants, Electricity.

Basic air and water emission requirements, and power plant design and operating characteristics are defined. Air pollution control particulate removal devices and a variety of flue gas desulphurization (FGD) alternatives are compared in terms of economic and technical applicability, water requirements, water consumption, and liquid and solid wastes production during power station operation with different types of coal. Three possible station water management systems (once-through, recirculation with limited discharge, and zero discharge) are evaluated under selected conditions, and their impacts on water intake, consumption and wastewater treatment are compared in detail. Coal type is shown to have a strong influence on the quantities of wastes produced and type of air pollution control devices which may be used. In turn, the types of control devices selected are also shown to affect the nature of subsequent wastewater and solid wastes problems. Wastewater recirculation and re-use designs incorporated into station water use related to air pollution controls are found useful in reducing water consumption and wastewater production and treatment requirements. (WATDOC)
W80-04565

EVALUATION OF INDUSTRIAL WASTE CARBON SOURCES FOR BIOLOGICAL DENITRIFICATION,
Environmental Protection Service, Ottawa (Ontario). Water Technology Centre.
H. D. Monteith, T. R. Bridle, and P. M. Sutton.
Report No EPS 4-WP-79-9, 1979. 71 p, 8 Fig, 8 Tab, 16 Ref, 3 App.

Descriptors: *Biological denitrification, *Industrial wastes, Substrate consumption, Waste characterization, Oxygen demand, Organic carbon, Nitrogen, Methanol.

Concern over impairment of water quality by both industrial and municipal effluents has resulted in extensive investigations into nitrogen removal processes. Biological dentrification is one of the most economical and effective means of nitrate reduction. The process involves the conversion of nitrate to dinitrogen (N2) using organic carbon as the electron donor. Methanol appears to be the most popular electron donor. Although methanol has certain advantages, its significant disadvantage is cost and this alone justifies consideration of alternative electron donors. A project was initiated to identify and evaluate industrial wastes or waste by-products which could be used as replacements for methanol. Forty-one waste samples were collected and chemically analyzed to determine their organic carbon and nitrogen concentrations. Bench scale testing followed, with the determination of batch denitrification rates for 30 of the characterized wastewaters. Twenty-seven of the 30 wastes exhibited denitrification rates equal to or greater than that observed using methanol. Many of the wastes exhibited substrate consumption ratios equal to or less than that for methanol. Data analysis showed a correlation between the initial FOC:N ratio and substrate consumption ratio. Evaluation of costs for transportation of waste carbon sources by truck are compared to methanol disposal. (WATDOC)
W80-04569

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),
For primary bibliographic entry see Field 6E.
W80-04582

THE EFFECT OF WATER PRETREATMENT CHEMICALS ON THE PERFORMANCE AND DURABILITY OF REVERSE OSMOSIS MEMBRANES,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 3A.
W80-04596

BIODEGRADATION OF THIOCYANATE BY MICROORGANISMS ISOLATED FROM GAS LIQUOR,
North Dakota State Univ., Fargo. Dept. of Biochemistry.
J. A. Fleeker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175029, Price codes: A03 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Research Project Technical Termination Report, November 1978. p 26, 6 Fig, 2 Tab, 24 Ref. OWRT A-054-NDAK(1).

Descriptors: *Biodegradation, *Bacteria, *Microbial degradation, *Waste water treatment, Coals, Soil microbiology, Cultures, Microorganisms, Soil bacteria, Tracers, Spectrophotometry, Chromatography, Analytical techniques, Arthrobacter, Thiocyanate.

Enrichment culture techniques were used to isolate an Arthrobacter species capable of using thiocyanate as a nitrogen source. Thiocyanate, a pollution indicator, is found in waste waters from coal gasification and coke production. Two enrichment media were used, a carboxylic acid-mineral medium (CM) and a glucose-mineral medium (GM); both were successful in producing isolates. The colony studied was isolated from a soil sample taken adjacent to a railroad bank and was isolated with the GM enrichment medium. The Arthrobacter isolated is gram-positive, heterotrophic, polymorphic, and grows in salmon-colored, opaque colonies. It is able to grow on alcohols, amines, carbohydrates, and acids. The Arthrobacter can degrade thiocyanate even in the presence of ammonium or nitrate ions. It tolerates thiocyanate in concentrations up to 0.1M. Analytical methods used include spectrophotometry, paper chromatography, quanine-cytosine content analysis, and radioisotopic analysis. Radioactive thiocyanate and the release of radioactive C02 were used to monitor decomposition rates. Results show that thiocyanate degradation falls to low levels as growth approaches the stationary phase. Unsuccessful attempts were made to produce a cell-free extract of the Arthrobacter that could chemically change thiocyanate. (Seigler-IPA)
W80-04605

IRRIGATION RETURN FLOW TREATMENT BY BIOLOGICAL DENITRIFICATION PROCESS FOR NITRATE REMOVAL,
North Dakota Univ., Grand Forks. Dept. of Civil Engineering.
Y. T. Hung, and G. O. Fossum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175318, Price codes: A06 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, North Dakota State University, Fargo Research Project Technical Completion Report, September 1979. p 102, 18 Fig, 41 Tab, 10 Ref. OWRT A-058-NDAK(1).

Descriptors: *Denitrification, *Anaerobic bacteria, *Biological treatment, *Water purification, *Irrigation water, Nitrates, Nutrient removal, Potable water, Reclaimed water, Water quality, Biodegradation, Waste water treatment, Eutrophication.

Anaerobic upflow continuous biological filters were used to remove excessive nitrate-nitrogen (N03-N) from irrigation return flows which typically contain high concentrations of N03-N. A maximum N03-N level of 10 mg/l in drinking water is specified by national regulations. For the study synthetic irrigation return flow was used composed of water from the Water Treatment Plant at Grand Forks, North Dakota, supplemented with various concentrations of sodium nitrate and methanol. Anaerobic bacteria from settled sludge from the Water Treatment Plant were acclimated in a batch reactor for two months. For the filters, three columns were constructed of clear lexan polycarbonate to a height of 6 ft with a 3 in inside diameter. Feed concentrations were varied from 5 to 100 mg/l N03-N and methanol to N03-N ratios ranged from 0.5 to 3.0. Various hydraulic loading rates tested ranged from 132 to 1,222 gpd/sq ft. Results show that the filters are a feasible method of denitrification of irrigation return flow. For a feed of 40 mg/l or less of N03-N, a 2 ft column produced acceptable water with 10 mg/l or less N03-N. Results are given for other combinations of feed concentration, methanol concentration, and loading rates. The deterioration of nitrate samples were also investigated with respect to storage time and chemical preservation of feed water. (Seigler-IPA)
W80-04610

RADIO-MANGANESE, -IRON, AND -PHOSPHORUS UPTAKE BY WATER HYACINTH AND ECONOMIC IMPLICATIONS,
University of South Florida, Tampa.
For primary bibliographic entry see Field 2I.
W80-04649

NUTRITIONAL COMPOSITION OF WATER HYACINTHS GROWN ON DOMESTIC SEWAGE,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A.
W80-04660

THE EFFECT OF SEWAGE EFFLUENT ON THE STRUCTURE AND FUNCTION OF A FRESHWATER TIDAL MARSH ECOSYSTEM,
Rider Coll., Trenton, NJ. Dept. of Biology.
D. F. Whigham, R. L. Simpson, and K. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176100, Price codes: A08 in paper copy, A01 in microfiche. New Jersey Water Resources Research Institute, Rutgers University, New Brunswick. Final Technical Completion Report, February, 1980. 160 p, 23 Fig, 82 Tab, 56 Ref. OWRT B-060-NJ(4), 14-34-0001-6099.

Descriptors: *Nutrient removal, *Sewage treatment, *Tidal marshes, *Freshwater marshes, *Marsh plants, Soil algae, Litter, Decomposing organic matter, Primary productivity, Chlorophyll, Dissolved oxygen, Carbon dioxide, Nitrogen, Phosphorus, Soil, Water pollution control, Waste assimilative capacity, Biomass, Chlorophyta, Chrysophyta, Euglenophyta, Cyanophyta, Nitrates, Nitrites, Ammonia, Delaware River, *Hamilton marshes(NJ), New Jersey.

The effects of spraying chlorinated secondarily treated sewage on a Delaware River freshwater tidal wetland for three years was studied. Macrophyte net primary production was significantly lower in the experimental sites receiving sewage than in the no treatment controls in 1975 but not in 1976 or 1977. Diversity of annuals was reduced in the experimental sites largely due to the elimination of annuals. Although percent N and P were generally high in the vegetation of experimental sites, there was little difference in Total N and Total P between treatments and controls. Macrophyte decomposition rates were little affected by sewage application. Substrate N and P were not significantly different between sites, but surface litter of the experimental sites accumulated N and P. Epibenthic algae may contribute to this accumulation. Water quality studies showed the high marsh to be metabolically active. Tide cycle flux studies indicated that up to 40% of the N added to the wetland was assimilated during the late spring - early summer period. Conversely, there was a net loss of P from the wetland. These results are compared with those of similar studies in other wetlands. It is concluded that the strongly pulsed tidal regimes of the wetland, the low organic content substrate, and the eutrophic nature of Delaware River waters contribute to the inability of the wetland to efficiently assimilate nutrients from sewage.
W80-04674

RESPONSE OF BIOLOGICAL REACTORS TO THE ADDITION OF POWERED ACTIVATED CARBON,
Connecticut Univ., Storrs. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W80-04680

GLYCERIA MAXIMA (HARTM.) HOLMB. IN PONDS SUPPLIED WITH POST-SEWAGE WATER,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
T. Ozimek, and L. Klekot.
Aquatic Botany, Vol 7, p 231-239, 1979. 1 Fig, 4 Tab, 18 Ref.

Descriptors: *Aquatic plants, *Waste treatment, *Growth rates, Municipal wastes, Domestic wastes, Industrial wastes, Nutrients, Plant growth, Biomass, Nitrogen, Phosphorus, Potassium, Water chemistry, *Glyceria.

Glyceria maxima growing in a pond supplied with post-sewage water (sewage after biological and mechanical treatment) grows very well, attaining a high biomass of 1.5 kg dry weight/sq. m. of an overgrown surface, and accumulating large amounts of different elements, e.g. 46.2 g N, 7.9 g P and 31.1 g K/kg dry weight of plants. The plant offers possibilities for the purification of waters polluted by municipal and industrial waste. (Deal-EIS)
W80-04730

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
C. Binkley, B. Collins, L. Kanter, M. Alford, and M. Shapiro.
Lexington Books, Lexington, MA. 1975. 120 p.

Descriptors: *Water quality, *Sewage systems, *Interceptor sewers, *Conveyance structures, *Sewers, *Urban land use, *Urban impact, *Urbanization, Water quality management(Applied), Sewage, Urban drainage, Social aspects, Project design, Environmental effects, Public participation, Cost-benefit analysis, Mathematical studies, Costs, Capacity, Flow rates.

This book is based on a study which was undertaken to analyze the relationship of urban growth and the federal sewer grant program. Recent interceptor projects financed by U.S. Environmental Protection Agency grants are examined to determine how they affect residential development in the areas where they are built. Alternative methods of interceptor financing with important land use implications include withholding of funds unless certain land use objectives are met, changing the grant formula, and limiting or curtailing funding of reserve capacity. Eight case studies were undertaken to determine which of the policies would work best under varying conditions; summaries are presented for four. Interceptor design and its relation to land use are discussed. An overview of the size and scope of projects in the study sample is presented. Factors influencing interceptor costs are discussed and data obtained in the study are analyzed. Excess capacity built into the interceptors sampled averaged $145 per capita, with costs as high as $658 per capita occurring. Interceptor staging policies are analyzed to pinpoint no Federal funds for excess capacity; reevaluation of interceptor staging of project design in rapidly growing areas; using realistic standards for per capita flow; improving population forecasting techniques and review procedures; requiring consideration of environmental effects of interceptor-induced land use; and increasing public participation in the planning process by publicizing community costs and benefits of interceptor-induced growth. (Arnold-NC)
W80-04751

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
For primary bibliographic entry see Field 8A.
W80-04773

FEDERAL ENVIRONMENTAL LITIGATION IN 1976: THE FEDERAL WATER POLLUTION CONTROL ACT,
For primary bibliographic entry see Field 6E.
W80-04783

5E. Ultimate Disposal Of Wastes

BOREHOLE GEOPHYSICS AS APPLIED TO THE MANAGEMENT OF RADIOACTIVE WASTE -- SITE SELECTION AND MONITORING,
Geological Survey, Denver, CO. Water Resources Div.
W. S. Keys, D. E. Eggers, and T. A. Taylor.
In: Management of Low-Level Radioactive Waste, Carter, M.W., and others, eds: New York Pergamon Press, Inc., Elmsford, p 955-982, 1979. 7 Fig, 3 Tab, 25 Ref.

Descriptors: *Borehole geophysics, *Radioactive wastes, *Waste disposal wells, *Injection wells, Sites, Monitoring, Borehole cameras, Radioactive well logging, Subsurface investigations.

The U.S. Geological Survey is conducting research on borehole geophysics, including the application of well logging to the investigation of radioactive waste disposal sites. During the past 14 years, eight such sites have been studied. Geophysical well logging provides in situ measuring techniques which can be used to supplement conventional coring and water sampling techniques in both site-selection studies and in the monitoring of operating disposal sites. Some of the advantages of well logging over conventional techniques include the relatively large volume of rock that can be investigated and the ability to measure temporal changes. Logging also reduces the amount of expensive coring required. Logs provide a continuous record of data that can be correlated from hole to hole. Data from geophysical logs can be interpreted in terms of lithology, elastic moduli, bulk density, porosity, moisture content, water quality, and the location and orientation of fractures. Fracture permeability can provide avenues for rapid water movement. After a site is in use, borehole geophysics provides a means to monitor changes in moisture content, water level, and radionuclide concentration in either cased or open holes. Water samples usually provide data only on the permeable intervals below the water table. Gamma spectral logging techniques provide data for any point in the well in relation to vertical and lateral distribution of contaminants. Radionuclides that have migrated from several operating sites have been identified. Detection limits on the order of 0.2 picocuries per gram have been attained for 60Co and 137Cs. A number of other gamma-emitting radioisotopes can be identified using inhole gamma spectrometry. (Kosco-USGS)
W80-04561

THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 - THE NEWEST ENVIRONMENTAL 'SLEEPER'.
American Bar Association, Washington, DC. Committee on Environmental Controls.
For primary bibliographic entry see Field 6E.
W80-04575

5F. Water Treatment and Quality Alteration

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
For primary bibliographic entry see Field 8A.
W80-04773

THE MUNICIPAL PROGRAM OF THE CLEAN WATER ACT: 1978 ADMINISTRATIVE IMPLEMENTATION,
For primary bibliographic entry see Field 6E.
W80-04797

5G. Water Quality Control

PREVENT GROUND WATER CONTAMINATION BEFORE IT'S TOO LATE,
Camp, Dresser and McKee, Boston, MA.
For primary bibliographic entry see Field 5B.
W80-04666

GROUND WATER VS. HAZARDOUS WASTES,
National Water Well Association, Worthington, OH.
T. C. Gass.
Water Well Journal, Vol 34, No 2, p 38-39, February, 1980. 2 Fig.

Descriptors: *Ground water, *Water pollution control, *Waste disposal, Hazards, Attenuation, Absorption, Waste dilution, Dispersion, Path of pollutants, Persistence, Regulations, Law enforcement, Legislation.

Ground water contamination by hazardous wastes can occur through poorly-designed landfills, industrial liquid waste impoundments, and underground contaminant facilities. Contaminants in ground water tend to be removed or reduced with time and distance by adsorption, dilution and dispersion. Contaminants form a plume, the shape and size of which depend upon local geology, ground water flow, type and concentration of contaminants, continuity of waste disposal and any man-made changes such as well pumping. Ground water contamination may persist for years if a contaminant is not readily absorbed or degraded. Local, state and federal governments help protect ground water resources by promulgating and enforcing hazardous waste disposal regulations. The Safe Drinking Water Act, Resource Conservation and Recovery Act, and Toxic Substances Control Act are examples of federal legislation which have provisions for ground water protection. (Purdin-NWWA)
W80-04675

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
For primary bibliographic entry see Field 4A.
W80-04746

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5D.
W80-04751

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 10C.
W80-04753

STANLY COUNTY FEASIBILITY REPORT FOR ON-SITE WASTEWATER SYSTEMS MANAGEMENT: PHASE I,
Stanly County Health Dept., Albemarle, NC.
B. R. Gray, S. C. Grayson, J. P. Straley, B. L. Kays, and B. L. Carlile.
(1979). 108 p, 11 Fig, 15 Tab, 5 Append. P004198013.

Descriptors: *Waste water treatment, *Water quality, *Surface waters, *Subsurface waters, *Stanly County(NC), *Water management(Applied), Waste water(Drainage), Water treatment, Waste water disposal, Septic tanks, Administrative costs, Maintenance costs.

The authors discuss a three month study of the feasibility of Stanly County, NC, providing management of its own on-site wastewater disposal system in practical, legal, technical, political and financial terms. A county managed system was determined necessary to protect adequately the area's surface and subsurface water quality. The investigation included aerial infrared photography surveillance, in which approximately 2,000 homes were surveyed for surfacing sewage effluents, with problems detected around 40% of the dwellings, and system failures discovered in 12%. The county

has inherent problems in the design of ground absorption sewage disposal systems due to its soil types. Hydraulic conductivity studies were undertaken at selected sites based on type of subsoil and the amount of that soil across the county. Guidelines are presented for alternative pressure systems and for tanks, pumps, controls, and drainfields for low pressure home sewerage systems. An economic analysis was undertaken to determine financial feasibility. Various elements of the cost included an initial sinking (or contingency) fund, regular maintenance costs and administrative costs, and financing of system improvement to cover costs of renovation. The number of customers would have a major influence on monthly costs to individual customers. Areas for study in Phase II of the project include education of local officials and the public in water quality management needs, finding further methods of financing the overall program, and effecting amendments in the Federal 201 facilities plan so that more dollars will be available for water quality management. (Arnold-NC)
W80-04771

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
For primary bibliographic entry see Field 6E.
W80-04791

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
For primary bibliographic entry see Field 6E.
W80-04796

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPTIMIZING FLOOD OPERATION RULES,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard, and S. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176639, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No CRWR-166, November 1979. 48 p, 9 Tab, 20 Ref, 1 Append. OWRT B-182-TEX(1).

Descriptors: *Flood control, *Reservoir operation, *Optimization, *Dynamic programming, Computer programs, Computer models, Mathematical models, Flood damage, Peak discharge, Stochastic processes, Reservoir releases, Flood protection, Mississippi, Inflow, Reservoir stages.

Stochastic dynamic programming was used to formulate flood-control reservoir operation rules with provisions for traditional considerations, flood-warning time, and damage increase due to flooding duration. Since future inflows into a given reservoir are not known, all floods of record that followed each classification of system state were taken as representative of all floods to follow that class of system state. The three dimensions of system state are initial reservoir storage, current inflow, and rate of change of inflow. A discussion of dynamic programming formulation for the least-expected-damage reservoir release policy is given along with the traditional release rule. These are coded in the program UTFCO-University of Texas Flood Control Operations. Input preparations and program source listings are provided. The program is illustrated using records for the Pearl River at Jackson, Mississippi, for 1914-1969. Operational rules were developed for a hypothetical reservoir having a flood control capacity of 150,000 acre-feet. The example used is based on daily in flows but the model also applies to complete records of average streamflows for shorter intervals. Program computational costs are about 10 to 40 times the costs of traditional approaches depending on the number of storage levels used. Storage required to compile on a CDC Cyber 170/175 is 62,000 octal and to run 131,000. (Seigler-IPA)
W80-04501

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
L. Druffel, G. J. Stiltner, and T. N. Keefer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301175, Price code: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-99, September 1979. 47 p, 20 Fig, 6 Tab, 15 Ref.

Descriptors: *Probability, *Hydrologic budget, *Dam failure, *Model studies, *Idaho, Reservoirs, Analytical techniques, Mathematical models, Flood wave, Discharge(Water), Floodflow, Flood routing, Simulation analysis, Streamflow, Flow rates, Big Lost River Valley(Idaho), Mackay Dam(Idaho).

Mackay Dam is an irrigation reservoir on the Big Lost River, Idaho, approximately 7.2 kilometers northwest of Mackay, Idaho. Consequences of possible rupture of the dam have long concerned the residents of the river valley. The presence of reactors and of a management complex for nuclear wastes on the reservation of the Idaho National Engineering Laboratory (INEL), near the river, give additional cause for concern over the consequences of a rupture of Mackay Dam. The objective of this report is to calculate and route the flood wave resulting from the hypothetical failure of Mackay Dam downstream to the INEL. Both a full and a 50 percent partial breach of this dam are investigated. Two techniques are used to develop the dam-break model. The method of characteristics is used to propagate the shock wave after the dam fails. The linear implicit finite-difference solution is used to route the flood wave after the shock wave has dissipated. The time of travel of the flood wave, duration of flooding, and magnitude of the flood are determined for eight selected sites from Mackay Dam, Idaho, through the INEL diversion. At 4.2 kilometers above the INEL diversion, peak discharges of 1,550.2 and 1,275 cubic meters per second and peak flood elevations of 1,550.3 and 1,550.2 meters were calculated for the full and partial breach, respectively. Flood discharges and flood peaks were not compared for the area downstream of the diversion because of the lack of detailed flood plain geometry. (Kosco-USGS)
W80-04551

REGIONAL DROUGHT AND FLOOD FREQUENCY ANALYSIS: THEORETICAL CONSIDERATION,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol 46, No 3/4, p 265-279, April 1980. 1 Fig, 22 Ref.

Descriptors: *Droughts, *Flood frequency, *Theoretical analysis, Hydrology, Hydrologic data, Floods, Water shortage, Properties, Disasters, Probability, Stochastic processes, *Regional drought, *Flood frequency analysis, Hydrologic phenomena, Normal distribution, Extreme value statistics, Random variables, Water resources systems analysis.

The problems of regional drought and flood analysis were approached theoretically on the basis of random fields. Necessary formulations for the regional drought descriptors such as the deficit area, the total areal deficit, and the maximum deficit intensity were derived. The joint and marginal probability distribution functions of areal drought/flood descriptors were derived for simple cases on the basis of random fields and probability theory. The relationships between expectations of descriptors were explicity furnished which are useful tools in any regional drought and flood assessment. The extreme event probabilities of the whole area covered by a drought were obtained. (Roberts-ISWS)
W80-04618

LEVEL-B MULTIOBJECTIVE PLANNING FOR WATER AND LAND,
Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
Y. Y. Haimes, P. Das, and K. Sung.
Journal of the Water Resources Planning and Management Division, Vol 105, No WR2, p 385-401, September 1979. 2 Fig, 2 Tab, 41 Equ, 18 Ref. OWRT C-7047 (No 6221)(7).

Descriptors: *Multiple-purpose projects, *Land use, *Planning, *Water resources, *Maumee River basin(Indiana), *Water pollution, *Model studies, Decision making, Optimization, Cost minimization, Constraints, Environmental quality, Economics, Surrogate Worth Trade-Off Method, Pollution abatement, Point source pollution, Non-point source pollution, Recreation, Waste water treatment, Wild-life habitats, Equations, Systems analysis.

Presented are multiobjective optimization models representing economic development and environmental quality relating to water quality and land use planning. Linear programming is used to derive least-cost point and nonpoint source pollution abatement alternatives, including other related land activities. The environmental quality sector includes the following noncommensurable objectives: (1) soil erosion and sediment control; (2) control of phosphorus discharge from point and nonpoint sources; (3) abatement of biological oxygen-demanding material from point sources; (4) enhancement of land-based recreational opportunities; (5) maintenance of wildlife habitat; and (6) flood control. A trade-offs analysis is carried out using the Surrogate Worth Trade-Off Method. A planning framework is developed for the Maumee River Basin Level-B Study. A recommended plan with its associated trade-off values is presented, and the decision-maker's (Planning Board) role in obtaining a basin-wide plan is discussed. (Bell-Graf-Cornell)
W80-04679

THE GREEN RIVER BASIN ROUTING MODEL,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
H. Yazicigil, A. R. Rao, and G. H. Toebes.
Hydraulics and Systems Engineering, CE-HSE-79-1, 1979. 141 p, 39 Fig, 16 Tab, 20 Ref, 3 Append. DAW 27-74-C-0012.

Descriptors: *Reservoir operation, *River forecasting, *Systems analysis, River management, Reservoir releases, Reservoir storage, *Streamflow forecasting, Model studies, Kentucky, *Green River basin(KY).

Systems analysis techniques are applied to the operation of a series of four flood control reservoirs on the Green River in Kentucky. The reservoir system is regulated by the Louisville District Corps of Engineers. In an earlier report a set of four correlative precipitation-runoff models were built for the watersheds controlled by the reservoirs. A sequel is a larger optimization-simulation model that can be used as an aid in day-to-day operations of the reservoir systems. This includes a streamflow model which can be used to forecast flows in the 'central' part of the Green River Basin; that is, the river system downstream of the outlet works of the four reservoirs. In addition to the model constructed in the study, stochastic models of daily flow series at the Green River outflow station, Calhoun, were developed. The ARMA and AR models were tested as to their performance in forecasting streamflow. Both models performed equally well with one or two day lead times, however their accuracy diminished with time. The model developed for this study GRBSYS2 performed better over time than those mentioned above. (Rao-Purdue)
W80-04744

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.

For primary bibliographic entry see Field 10C.
W80-04753

MULTI-OBJECTIVE ANALYSIS IN WATER SUPPLY AND MANAGEMENT PROBLEMS FOR A SINGLE RIVER BASIN,
Kobe Univ. (Japan). Dept. of Systems Engineering.
M. Sakawa.
Water Supply and Management, Vol 3, No 1, p 55-64, 1979. 8 Ref, 3 Fig, 2 Tab.

Descriptors: *River basins, *Water supply, *Water management(Applied), *Model studies, *Multi-objective model, *Japan, *Kakogawa River Basin(Japan), *Hyogo Prefecture(Japan), Nonlinear programming, Decision making, Cost assessment, Surrogate Worth Trade-off method, Planning, River basin development, Water resources, Watershed management.

The objective of this study is to develop a multi-objective water supply and management model for a single river basin. The model which is constructed is formulated as a multi-objective nonlinear programming problem. It is assumed that the decision maker's objectives include minimizing total cost associated with construction and operation of the facilities, minimizing pollution and maximizing water supply for the basin. The Surrogate Worth Trade-off method is used to resolve the conflicts between the objectives. For the framework of planning the author assumes that dams are constructed to develop available fresh water in the headwaters of the river basin; industrial and domestic water-conveyance systems between zones are taken into consideration; and in each zone, both fresh and renovated water are utilized, where highly treated water by tertiary treatment plants can be reused for industrial usages only. The model is applied to the study area of the Kakogawa River Basin in Hyogo Prefecture. The solution procedure utilized an epsilon-constraint method using the generalized reduced gradient (GRG) algorithm. In this model in order to obtain the most preferable solution it is important for the decision maker to quantify the preference among the objectives in accordance with the situation of his concern. The author concludes that this model can be applied to other single river basins with some modifications. (Iervolino-NC)
W80-04759

ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,
Hydrologic Engineering Center, Davis, CA.
W. K. Johnson, and D. W. Davis.
Training Document No 7, November 1975. 203 p, 26 Fig, 13 Tab, 6 Ref, 1 Append.

Descriptors: *Non-structural alternatives, *Flood control, *Flood plain management, *Analytical techniques, *Cost-benefit analysis, *Fall River(CA), *Planning, Land use, Hydrologic aspects, Stage-discharge relations, Flood discharge, Flood damage, Flood control, Water resources management, Levees, Floodwalls, Reservoirs, Channel improvement, Diversion, Flood forecasting, Floodproofing, Warning systems, Computer programs, Economics, Mathematical models.

The authors illustrate how various flood control measures can be analyzed using the HEC-5C computer program. Basic principles in flood control planning and damage reduction are examined. Flood plain management measures include those designed to control hydrology and those designed to reduce susceptibility of property to damage. Hydrologic and economic relationships are examined and the affects of different types of flood control measures are presented. Of the eight control methods, levees or floodwalls were found to affect the stream's stage-discharge, stage-damage, discharge-damage, and damage frequency relationships. Diversion and flood forecasting affected these relationships the least, but all the methods affected the damage frequency. The HEC-5C program was used to develop systems which maximize net economic benefits. Given an existing system and an array of flood control measures, the strategy proceeds by computing expected annual damages for the existing system; adding any one of the flood control measures and computing expected annual damages; then subtracting expected annual damages with or without the control measure. Finally, the best measure was chosen based upon its final net benefit yield. A final added strategy recomputed costs and benefits by removing one of the control measures to determine if a better net benefit figure would be yielded. The Fall River System of California was used to illustrate how the program functions. (Arnold-NC)
W80-04772

6B. Evaluation Process

MEASURING THE SOCIAL IMPACTS OF WATER RESOURCES PROJECTS,
Kansas Water Resources Research Inst., Manhattan.
C. B. Flynn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173545, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, April 1980. p 21, 7 Fig, 2 Tab. OWRT A-084-KAN(1), 14-34-0001-7035.

Descriptors: *Kansas, *Hillsdale Dam(Kan), *Mud Creek(Kan), Water resources projects, *Social impact, *Construction, *Hydraulic structures, Evaluation, Dependent variables, Independent variables, Quantitative variables, Qualitative variables.

Two water resources projects, the Hillsdale Dam Construction and the Mud Creek Rechannelization, were examined in order to determine whether projects of different sizes produce social impacts of different sizes. The study (1) identified a wide range of social impacts (dependent variables) and those of elements of the projects which affect the magnitude of the impacts (independent variables); (2) defined appropriate geographical impact areas within which changes in the independent variables could be expected to effect changes in the dependent variables; (3) operationalized the variables so that measurements could be obtained for the impact areas; (4) measured the variables for projects in the planning stages; and (5) monitored the variables over time, that is, during and after the construction of the projects. The results indicated that although the quantitative variables monitored did not vary by size of project, the qualitative variables did.
W80-04601

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04752

A SYSTEMS RESOURCES APPROACH TO CITIZEN PARTICIPATION: THE CASE OF THE CORPS OF ENGINEERS,
North Carolina State Univ. at Raleigh. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W80-04756

RIVER AMENITY EVALUATION: A REVIEW AND COMMENTARY,
North Central Forest Experiment Station, St. Paul, MN.
E. C. Leatherberry.
Water Resources Bulletin, Vol 15, No 5, p 1281-1292, October 1979. 21 Ref.

Descriptors: *Rivers, *Recreation, *Evaluation, *River resource assessment, *River esthetic assessment, *Benefits, *Assessments, River basin development, River designation, Riparian rights, Wildlife conservation, Classification, Value, Environmental effects, National Wild and Scenic River Act, Preservation.

River amenity evaluation refers to the assessment of features, or conditions, in riparian environments that may provide recreational, or preservational and esthetic values. This report reviews methods of evaluating river amenity values and divides them under three main headings: River Recreation Potential Evaluation, River Esthetic Evaluation and River Preservation Evaluation. Under the first heading the different methods attempt to evaluate recreation potential of rivers by assessing the utility of physical characteristics and other environmental effects for recreation activities. These methods did not adequately represent the dynamic nature of the resource and the potential users. The two methods for evaluating river esthetics had many shortcomings, e.g., they were dependent on the evaluator's personal judgment and photographs were not considered. The evaluation of river esthetics needs to consider what effect people and their impact have on the esthetic quality of the resource. Under the heading of River Preservation Evaluation the methods reviewed are designed to assess the suitability of rivers or river segments for classification in state or federal river preservation programs. The passage of the National Wild and Scenic River Act (PL 90-542) in 1968 instigated the classification of rivers for preservation and recreation purposes. In order to improve the methods they should (1) be capable of identifying and predicting change and its impact on amenity values; (2) incorporate concepts and techniques that measure the dimensions of people's feelings about specific environmental features; and (3) place more emphasis on the quality of the experience to be provided. (Iervolino-NC)
W80-04758

PLANNING UNDEVELOPED LAKESHORE: A CASE STUDY ON LAKE CHAMPLAIN, FERRISBURG, VERMONT,
Vermont Univ., Burlington. Dept. of Agricultural and Resource Economics.
F. O. Sargent, and P. R. Berke.
Water Resources Bulletin, Vol 15, No 3, p 826-837, June 1979. 3 Fig, 7 Ref.

Descriptors: *Water resources planning, *Planning, *Ferrisburg(VT), *Lake Champlain(VT), *Lake shores, *Land management, *Shore protection, *Recreation, *Outdoor recreation, Shores, Lakes, Land development, Land resources, Land conservation, Land use, Public access, Recreation.

Development of private lakeshores usually precedes establishment of public access, resulting in the best access areas being occupied before public access is provided. The authors present an analytical procedure developed to enable planners to classify undeveloped lakeshore areas according to their suitability for public and private uses. The undeveloped lakeshore evaluation system rated the physical characteristics of the lakeshore for five of the most common uses: (1) public beaches; (2) camping and picnicking areas; (3) boat access areas; (4) marinas; and (5) development-vacation homes, cottages, and motels. Standards for rating the lakeshore potential have been developed for the following site requirements: size, slope, soil suitability, shoreline type (sand, rock, muck, or gravel), water quality, site location, scenery, and road access. Each of these items are measured and rated on a numerical scale from 1 to 5; the basis of the rating is a comparison with other sites for a similar use in the town or region. The system is applied to Ferrisburg, VT, located on the southern reach of Lake Champlain, with a shoreline of 14 miles, 7 of which are undeveloped. Data sources for the ratings were air photos, USGS topographical maps, Soil Conservation Service maps, and other previous studies, plus a land and water visit to each site. The evaluation system was used to develop a lakeshore land use plan, the goals of which are: (1) protection of the natural lakeshore environment, including using all wetlands as conservation areas; (2) increasing the town tax base; and (3) providing more public access to the lake through a public marina and designated swimming areas. (Iervolino-NC)
W80-04760

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,

Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8C.
W80-04764

WATER SUPPLY SERVICE FOR THE URBAN POOR: ISSUES,
Colorado Univ. at Boulder. Inst. of Behavioral Science.
G. F. White.
Water Supply and Management, Vol 2, No 5/6, p 425-454, 1978. 6 Fig, 3 Tab, 33 Ref.

Descriptors: *World Bank, *Urban Poverty Program, *Urban Poor Target Population, *Water supply, *Water delivery, *Water supply development, Water demand, Urbanization, Cities, Administration, Water distribution(Applied), Water users, Water utilization.

The author outlines the critical issues involved in choosing what type of water supply service is appropriate and practicable in applying the policy of the World Bank for the urban poor to new water supply sector reports and project appraisals. The major issues involved in those decisions are: definition of target population, definition and criteria for describing alternative types of service; estimation of health benefits in relation to standards of quality and reliability; relative emphasis upon distribution and supply improvements; the thresholds of water use requiring sewerage; pricing, repayment and subsidy policy; institutional responsibility and public education; and employment generation. The Urban Poor Target Population is the greater of the absolute or relative poor populations. The objective of the Urban Poverty Program is to increase the income and consumption of the target population by: (1) reducing the cost of, or otherwise increasing access to, basic goods and services, and (2) increasing income earning opportunities and capacity. Immediate research needs for developing solutions to issues of water supply for urban poor include: critical appraisal of conspicuous successes and failures; comparative costs of alternative services and outline for and example of a study of current water use and preferences. Long term studies would include demonstration projects and systematic review of the experience with the World Bank's regular water supply and sewerage projects and with the water and sewerage components of the Sites and Services programs. (Iervolino-NC)
W80-04765

ESTIMATING COSTS AND BENEFITS FOR NONSTRUCTURAL FLOOD CONTROL MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6F.
W80-04769

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH CAROLINA.
Army Engineer Div. South Atlantic, Atlanta, GA.
January 1979. 123 p, 9 Maps, 35 Photos.

Descriptors: *Water resources development, *Flood control, *U.S. Corps of Engineers, *North Carolina, *Navigation, *Multiple-purpose projects, *River basins, *Coastal areas, Reservoirs, Project costs, Economics, Water demand, Federal government, Planning, Channel improvement, Water resources, Coastal plains, Beach erosion.

This report describes the scope and progress of water resource projects and studies by the U.S. Corps of Engineers in North Carolina. The functions of the Corps and initiation, authorization and construction of projects are described. Specific projects for the Coastal Area are presented, including 41 navigation projects, flood control in 15 areas, snagging and clearing, and beach erosion control. Studies and surveys underway and authorized are listed. There are 3 active coastal-wide projects--alteration of the Beaufort and Morehead City Railroad Bridge, aquatic plant control in estuarine waters, and the Atlantic Intracoastal Waterway. Corps projects are presented for each of eight river basins--Roanoke, Pamlico-Tar, Neuse, Cape Fear, Yadkin-Pee Dee, Santee-Catawba, Kanawha-New, and Upper Tennessee Basins. Two multipurpose projects are located in the Roanoke Basin--the John H. Kerr Dam and Reservoir with a total capacity of 2,750,349 acre-feet, installed power capacity of 204,000 kilowaters, and a drainage area of 2,750,349 sq mi above the dam, provides flood control, generation of hydroelectric power, recreation, fish and wildlife preservation and low-flow control, with cost to date of $88,362,641; and Philpott Lake, located on the Smith River, with a drainage area of 212 sq mi above the dam and total cost to date of $14,120,308. Falls Lake in the Neuse River Basin was authorized in 1965 as a flood control project. Projected completion is 1981. It will operate as part of a coordinated system for water supply, water quality and recreation. Total estimated cost is $100,000,000. Several projects have been deauthorized, one in the Yadkin-Pee Dee Basin and several in the Piedmont region. Statistical data are provided on a project-by-project basis, and maps show locations of the various projects. (Cooper-NC)
W80-04770

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04752

6D. Water Demand

ESTIMATED WATER USE IN FLORIDA, 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach, and H. G. Healy.
Geological Survey Water-Resources Investigations 79-112, 1980. 76 p, 4 Fig, 21 Tab, 28 Ref.

Descriptors: *Water utilization, *Florida, *Consumptive use, *Withdrawal, Municipal water, Irrigation water, Industrial water, Water supply, Thermal powerplants, Saline water, Freshwater.

During 1977, an average of 21,466 million gallons of water was withdrawn daily for use in Florida--an increase of 6,153 million gallons per day since 1970. The 1977 daily use was 14,812 million gallons of saline water and 6,654 million gallons of freshwater. Most of the saline water, largely surface water, was pumped from tidal estuaries. Only 107.6 million gallons per day of saline water--less than 1 percent--was obtained from wells. Thermoelectric power generation used virtually all the saline water, 14,738 million gallons per day, whereas all other industrial uses were only 73 million gallons of saline water per day. The freshwater supply was almost equally divided between ground water (53 percent) and surface water (47 percent). Of the total freshwater used, 43 percent was for irrigation--an average of 2,873 million gallons of freshwater daily on the average. The remaining daily use of freshwater was 21 percent for thermoelectric power generation, 19 percent for public supply; 14 percent for industrial use other than thermoelectric power generation; and 3 percent for domestic and rural use. Irrigation was also responsible for the greatest consumption during 1977, with 1,255 million gallons consumed daily which also includes 192 million gallons per day conveyance loss. (Kosco-USGS)
W80-04557

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
For primary bibliographic entry see Field 6E.
W80-04573

SPECIAL CONSIDERATIONS INVOLVING INDIAN RIGHTS,
Clyde and Pratt, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W80-04574

WATER USE AND SUPPLY DEVELOPMENT PLAN--EXECUTIVE SUMMARY.
South Florida Water Management District, West Palm Beach.
For primary bibliographic entry see Field 4A.
W80-04746

WATER CONSERVATION IN CALIFORNIA.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04750

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
S. M. Brown, F. L. Thompson, D. L. Hessel, L. Ortolano, and W. S. Hood.
Water Resources Bulletin, Vol 15, No 5, p 1236-1249, October 1979. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Conflicts, *Water quality, *Energy production, *Water pollution control, *Water supply, *Groundwater resources, Political aspects, Political constraints, Administration, Decision making, Programs, Planning, Conservation, Preservation, Environmental Policy Analysis Program, Environmental effects, Energy, Evaluation, Analysis.

The United States in the last decade has pursued two high priority goals: maintenance of high quality natural environments and achievement of energy independence. The pursuit of these two goals has resulted in numerous conflicts; this has led to the establishment of the Environmental Policy Analysis Program by the Energy Research and Development Administration (ERDA) which is now incorporated into the Department of Energy (DOE). The purpose of this program is to improve the formulation of energy development policies; it has been supported by detailed analysis conducted by the Pacific Northwest Laboratory (PNL), of specific issues related to the conflicts between energy development and environmental quality. These conflicts can be described and understood in terms of one or more of the following policy environment characteristics: resource scarcity, sense of urgency, lack of experience, administrative complexity, uncertainty about future policies and regulations, technological complexity and uncertainty about impacts. Two conflicts that were singled out because of their significance to DOE are (1) the contention by industry that certain regulations had been based on inadequate data, and (2) the energy development problems associated with water supply shortages in the arid West. Three prospective points of conflict identified are Best Available Treatment effluent limitations; the mandated regulations for controlling toxic and hazardous substances; and the new programs for controlling ground water quality. Resolving conflicts can be accomplished through an analysis of the policy environment and its characteristics which can provide a useful framework for the identification and selection of alternative actions. (Iervolino-NC)
W80-04755

WATER SUPPLY SERVICE FOR THE URBAN POOR: ISSUES,
Colorado Univ. at Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6B.
W80-04765

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH CAROLINA.
Army Engineer Div. South Atlantic, Atlanta, GA.
For primary bibliographic entry see Field 6B.
W80-04770

IMPACT OF ENERGY DEVELOPMENT ON THE LAW OF THE COLORADO RIVER,

For primary bibliographic entry see Field 6E.
W80-04775

IMPLICATIONS FOR THE FUTURE: DESIGN OF VIABLE INTERNATIONAL INSTITUTIONS,
Mexicano Inst. de Estudios Diplomaticos.
For primary bibliographic entry see Field 6E.
W80-04776

THE ENFORCEMENT OF FEDERAL RECLAMATION LAW IN THE WESTLANDS WATER DISTRICT: A BROKEN PROMISE,
For primary bibliographic entry see Field 6E.
W80-04790

REPORT TO GOVERNOR JOHN A. LOVE ON CERTAIN COLORADO WATER LAW PROBLEMS,
Holland and Hart, Denver, CO.
For primary bibliographic entry see Field 6E.
W80-04798

6E. Water Law and Institutions

A STATE OF KNOWLEDGE ON INDIAN WATER RIGHTS IN KANSAS,
Kansas Water Resources Research Inst., Manhattan.
D. C. Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-170632, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, February 1980. 48 p, 5 Fig. OWRT A-093-KAN(1).

Descriptors: *Kansas, *Indian reservations, *Water rights, *Riparian rights, Prior rights, Water law, Appropriation, Adjudication procedure, Equitable apportionment, Land tenure, Reservation doctrine, Water allocation(Policy), Federal jurisdiction, Irrigation water.

Much uncertainty surrounds Indian water rights in Kansas since they may be in conflict with State given rights to water. The ever increasing shortage of water in the arid areas of Kansas is forcing the State to clarify Indian water rights to avoid continuing and future conflicts. Kansas water law subscribed to both riparian water rights and to appropriation which provides all users as much water as they need toward a beneficial use. If the water supply is not adequate then those 'first in time' are 'first in right'. This leads to problems of whether or not Indian reserves were 'first in time'. Indian land tenure in Kansas is discussed for the original tribes as well as those brought to Kansas reservations from other states. Many tribes are involved including the Kansas, Osage, Wichita, Pawnee, Commanche, Apache, Kiowa, Cheyenne, Arapaho, Cherokee, Ottawa, Kickapoo, and others. Major areas of concern in Kansas Indian water rights are: (1) interstate water allocations, (2) Indian allotees rights including non-Indian owners, and (3) reservation Indian rights. One solution would be the computation of irrigable acreage for reservations and the projection of water use involved. This computation, while not a permanent, legal judgement, could be used as a guideline in disputes. Kansas must press the Federal Government for ascertainment and adjudication of water rights so that good planning can preclude conflicts. (Seigler-IPA)
W80-04503

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978,
Department of Commerce, Washington, DC.
R. O. Jones, W. J. Mead, and P. E. Sorenson.
Natural Resources Journal, Vol 19, No 4, p 885-908, October 1979.

Descriptors: *Continental shelf, *Resources development, *Mineral industry, *Oil industry, Legislation, Federal government, Administrative agencies, Leases, Bids, Oil pollution, Energy, Drilling.

The purpose of the 1953 Outer Continental Shelf Lands Act (Act) is to regulate the granting of mineral leases on the Outer Continental Shelf (OCS) by the federal government. The Act authorizes the Secretary of the Interior to grant mineral leases and to prescribe regulations for their administration. The 1978 Amendments respond to several areas of criticism of the 1953 Act: (1) Dissatisfaction with the primary leasing method in use - cash bonus bidding with a fixed royalty; (2) Coastal states desire to exercise more control of off-coast energy exploration; and (3) Desire for increased federal supervision of off-shore energy resources. Whereas the 1953 Act authorized only cash bonus or royalty bidding, the Amendments specify eight alternative bidding systems. Recent research shows that competition under the new bidding system has not been as intense as predicted. The 1978 legislation also mandates a significant expansion in economic planning by the Interior Secretary. These plans must be submitted to the governors of affected states for review and comment. The new legislation also provides for funds to compensate for damages arising from energy production from the OCS. (Wilson-Florida)
W80-04572

USE IT AND LOSE IT - SURFACE WATER RIGHTS IN IDAHO,
S. W. Reed.
Idaho Law Review, Vol 15, No 3, p 569-590, Summer 1979.

Descriptors: *Idaho, *Surface waters, *Public access, *Water quality control, Judicial decisions, Legal aspects, Public rights, Legislation, State governments, Water resources, Water rights, Water conservation.

The inevitable rush to ruin is occurring upon the natural lakes and rivers of Idaho. These lakes and rivers have been a recreational commons open for all to use. In recent years ruinous pressures have come from a rapidly increasing Idaho population and a growing use by non-residents. Conflicts over surface water rights arise in the courts and in federal, state and local governments. The judicial power over the surface waters of lakes and rivers is founded upon the public trust doctrine. The public trust doctrine has been applied to prohibit the issuance of permits to appropriate water for energy production facilities. The doctrine is not limited to prohibitions against private uses of the beds and surface waters, but may also be applied to public entities. A wide assortment of federal statutes have potential applicability to Idaho's waters, including the Rivers and Harbors Act of 1899. Idaho state control comes from the 1974 Lake Protection Act. The Act does little more than set up procedures to grant permits for various types of encroachments. County control comes from the 1975 Local Planning Act. (Wilson-Florida)
W80-04573

SPECIAL CONSIDERATIONS INVOLVING INDIAN RIGHTS,
Clyde and Pratt, Salt Lake City, UT.
E. W. Clyde.
Natural Resources Lawyer, Vol 8, No 2, p 237-252, 1975.

Descriptors: *Indian reservations, *Riparian rights, *Water allocation(Policy), Federal government, Water law, Riparian land, Diversion, Federal reservations, Agriculture, Water rights, Priorities.

Most of the land in the contiguous western states was obtained by the United States through the exercise of its sovereign powers. Since the United States originally owned the land, all settlers were trespassers. On the water rights issue, the courts ruled against riparian settlers and in favor of the first appropriator, because the settlers, owning no lands, were not in a position to assert the riparian rights doctrine. An exception to this rule of prior appropriation is the concept of reserved rights for Indians, generally known as the Winters Doctrine. Cases have arisen concerning the amount of water reserved for the Indians. The Indian water is held in trust by the federal government for the Indians. The power of the United States to reserve water could be based on its treaty powers. The Indians have a prior right to the water based on the date the Indian reservation was created. The water reserved for the Indians is not measured by past use, but by present and future needs. This determination is a judicial one for the federal courts. (Wilson-Florida)
W80-04574

THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 - THE NEWEST ENVIRONMENTAL 'SLEEPER'.
American Bar Association, Washington, DC. Committee on Environmental Controls.
The Business Lawyer, Vol 33, No 3, p 2555-2585, July 1978.

Descriptors: *Hazardous wastes, *Solid wastes, *Waste disposal, Permits, Agricultural runoff, Mine wastes, Waste dumps, Regulation, Administration, Water pollution.

These are the minutes of a program conducted by the American Bar Association's Environmental Controls Committee during which the 1976 Resource Conservation and Recovery Act (RCRA) was discussed. The discussion is focused on the RCRA's waste disposal regulating provisions. The RCRA amended the existing Solid Waste Disposal Act. Discussion is centered on the two major programs added by RCRA: (1) a hazardous waste management program; and (2) a program for phasing out solid waste open dumping. There are possible areas of overlapping between the RCRA and other federal laws. Potential problems the federal Environmental Protection Agency might face in administering the RCRA are discussed. These include: (1) defining those hazardous wastes to be regulated; (2) creating substantive standards for generators, transporters and owners or operators of facilities which treat, store, or dispose of hazardous wastes; and (3) obtaining state involvement. Potential sanctions for RCRA violations are examined. The Committee feels the RCRA has potentially widespread applicability and impact. (Daniels-Florida)
W80-04575

THE INLAND WETLANDS ACT: RECONCILING A COLLISION OF INTERESTS,
R. M. Hall, Jr.
Connecticut Bar Journal, Vol 48, No 1, p 3-29, March 1974.

Descriptors: *Connecticut, *Wetlands, *Permits, Preservation, Protection, Constitutional law, Regulation, Conservation, Legislation, Real property.

The provisions of Connecticut's Inland Wetlands Act are examined. There is a potential collision of interests between private landowners and the public at large resulting from the Act. The Act and administrative regulations attempt to resolve this potential collision. An analysis of past Connecticut wetlands cases provides insight into the reception the Act is likely to receive in court. The Act was passed as a response to concern over the need to protect and preserve inland wetland areas. Protection of wetlands is a proper legislative subject. Protection of wetlands is achieved by a permit system. Any regulation of private property raises potential conflicts of interest. The taking issue and the nuisance abatement theory are examined. The taking issue is divided into three theories: (1) the Physical Invasion Theory, which almost always requires compensation; (2) The Diminution of Value Theory, where the granting of relief is optional; and (3) the Benefit-Harm Balancing Theory. For a permit denial to be an unconstitutional taking there must be a total or nearly total destruction of the property's value, or the property must be rendered useless for any practical purpose. The Act, as a whole, is valid. (Daniels-Florida)
W80-04576

PROPERTY RIGHTS: INTERTRIBAL MINERAL RIGHTS IN THE ARKANSAS RIVERBED,
J. T. Branam.
American Indian Law Review, Vol II, No 1, p 125-135, Summer 1974.

Descriptors: *Arkansas, *Indian reservations, *Ownership of beds, *River basin development, Treaties, Boundary disputes, Patents, Legal aspects, Beds under water, Water law, Navigable waters.

The claims of three indian tribes, the Cherokees, the Choctaws and the Chickasaws, to the mineral rights in the stream bed of the Arkansas River are discussed. The U.S. Supreme Court ruled that the mineral rights in the Arkansas River belong to the Indian tribes, but did not settle the legal rights among the Indians. The general positions of the three tribes are given, including some of the supporting arguments of each position. Treaties and case law supporting each tribe's position are discussed and analyzed. Some possible courses of action to support each tribe's claim are discussed. General property principles are mentioned, but not fully discussed. No attempt is made to determine where the equitias lie. All positions are presented objectively. No final solution to the settlement of the Indian tribe's claims is offered. (Daniels-Florida)
W80-04577

BLUE LAKE: A STRUGGLE FOR INDIAN RIGHTS,
American Univ., Washington, DC.
J. J. Bodine.
American Indian Law Review, Vol I, No 1, p 23-32, Winter 1973.

Descriptors: *New Mexico, *Indian reservations, *Federal government, *Water allocation(Policy), National forests, Water rights, Treaties, History, Administrative agencies, Legislation, Water resources, Land use.

On December 15, 1970, the President of the United States (U.S.) signed into law House Bill 471, which gave trust title to 48,000 acres of land to the Taos Pueblo Indians of New Mexico. This ended a 64-year struggle by the Taos to regain their sacred Blue Lake and the high mountain land which surrounds it. This was the first time in the history of U.S.-Indian relations that a claim for land, based on the practice of aboriginal religion, successfully ended in the restoration of that land to an Indian reservation. The U.S. took over the entire region in 1848, assuming sovereignty under the Treaty of Guadalupe Hidalgo. Soon after, Anglo-American settlers began to filter into the area and settle on the traditional lands of the Taos. Blue Lake is the primary water supply source of the pueblo and consequently was of great importance to the area's agriculture. Repeatedly, the Taos made known their claims to portions of the land as non-Indian encroachment increased. Their struggle ended with House Bill 471. (Wilson-Florida)
W80-04578

GOVERNMENT REGULATION OF OIL POLLUTERS: HOW MUCH IS ENOUGH,
M. N. Mervin.
Administrative Law Review, Vol 29, No 4, p 603-609, Fall 1977.

Descriptors: *Regulation, *Oil pollution, *Administrative agencies, *Water pollution control, Legal aspects, Federal government, Oil industry, Legislation, Oil spills, Water law, Transportation, Environmental effects.

Although there has been considerable public debate over excessive government regulation, one type of overregulation has eluded the public eye - illegal, federal overregulation. An example of this type of violation is the Navigation Safety Regulations promulgated on January 31, 1977. The Secretary of Transportation declared that the new Regulations were tanker regulations developed to prevent oil spills. However, the regulations were promulgated not under the Tanker Act, but under a statute that authorizes control of vessel traffic under certain hazardous circumstances. This statute gives no general authority to prescribe navigation safety rules for all vessels everywhere. Another example of illegal overregulation is the regulation on Marine Portable Tanks. These regulations rely simultaneously on the Tanker Act and the Dangerous Cargo Act. However, the definitions of these acts are inconsistent. Moreover, these regulations have been issued without notice or opportunity to be heard, contrary to the Administrative Procedure Act. The irony in these cases of illegal regulation is that there is ample statutory authority to accomplish such regulation. (Wilson-Florida)
W80-04579

MUCH ADO ABOUT SOMETHING - DISPUTE SETTLEMENT AND THE LAW OF THE SEA CONVENTION,
National Security Council, Washington, DC. Interagency Task Force on the Law of the Sea.
R. H. Hull.
International Lawyer (A.B.A.), Vol 11, No 2, p 365-368, Spring 1977.

Descriptors: *Law of the Sea, *International commissions, *Negotiations, United Nations, Foreign countries, Treaties, International waters, Conferences, Oceans, Political aspects, International law.

For years, diplomats from many lands have been talking about the need for a new and equitable convention for the oceans. In general, the talk has focused on substantive matters. Recently, however, attention has begun to focus on an ostensible procedural question - the settlement of disputes arising out of the proposed Law of the Sea Convention. Implementation of a dispute settlement mechanism faces two primary problems. First, some states are reluctant to submit disputes to international forums for resolution. Second, many states are reluctant to have their disputes resolved by a third party. Assuming these two hurdles are overcome, the remaining question concerns the proposed provisions themselves. The dispute settlement procedure should, among other things, provide that: (1) parties may choose the means to resolve disputes; (2) methods for conciliation; (3) provisional measures to preserve the rights of the parties; (4) obligations to settle disputes by resort to arbitration or judicial settlement; and (5) disputes may only be submitted to the forum chosen by the party against which the proceedings are instituted. (Wilson-Florida)
W80-04580

THE CONCEPT OF FREE SEAS: SHAPING MODERN MARITIME POLICY WITHIN A VECTOR OF HISTORICAL INFLUENCE,
Pittsburgh Univ., PA. School of Law.
G. P. Smith, II.
International Lawyer (A.B.A.), Vol 11, No 2, p 355-363, Spring 1977.

Descriptors: *History, *Law of the Sea, *International law, Political aspects, Economics, Oceans, United Nations, Military aspects, Foreign countries, Conferences.

The concept of free seas entails conflicts and compromises. Both the politics of freedom and the concept of sovereignty have shaped the freedom of the seas and territorial waters. The historical concept of freedom of the seas, as to both ownership and use, was formulated early as a legal principle in the Roman characterization of the sea as the common property of all. In the Middle Ages, when Venice became a center of commerce, there was a strong competition among nations for use of the seas. Territorial supremacy became synonamous with sovereignty. The early politics of freedom, not sovereignty, shaped the English concept of the seas. This concept of freedom was the dominant principle by the twentieth century. Today, the United Nations Law of the Sea Conference considers anew the problems of contiguous zones and the extent of their application, exclusive economic zones, territorial seas, and coastal state jurisdiction. The continuing conflict is between expansion of sovereignty and the need for free, open seas. (Wilson-Florida)
W80-04581

ENVIRONMENTAL LAW (RESOURCE UTILIZATION, WATER POLLUTION AND AIR POLLUTION),
A. Rothstein, and D. R. Koss.
Annual Survey of American Law, Vol 1977, No 2, p 303-364, 1977.

Descriptors: *Resource development, *Industrial wastes, *Water pollution control, Legislation, Judicial decisions, Administrative agencies, Water pollution, Environmental effects, Energy, Mining, Legal aspects.

The national policy of establishing self-sufficiency in energy supplies has resulted in accelerated development of resources under federal control and increased impetus to energy research and development often at the expense of environmental quality. Some recent federal legislation bypasses the requirements of the 1969 National Environmental Policy Act (NEPA), and the courts have refused to construe NEPA more broadly than in past decisions. Part I examines three areas in which these trends have been evolving. First, legal challenges to the development of oil and natural gas resources on the outer continental shelf have revealed limits to NEPA's efficacy. Second, development of coal reserves in the northern Great Plains region has been encouraged by the 1975 Federal Coal Leasing Amendments Act and by the Supreme Court's conclusion that a regional environmental impact statement is not currently required prior to development. Third, commerce clause and federal preemption challenges have been raised against states attempting to exclude waste generated out-of-state. Part II discusses the Supreme Court's decision that the Environmental Protection Agency had authority to promulgate general regulations limiting the quantities of pollutants that may be discharged from existing industrial outlets. (Wilson-Florida)
W80-04582

COASTAL ZONE MANAGEMENT - A FEDERAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. W. Knecht.
Coastal Zone Management Journal, Vol 1, No 1, p 123-128, Fall 1973.

Descriptors: *Coasts, *Management, *Federal governments, *Governmental interrelations, Coastal engineering, Legislation, Coordination, Zoning, Local governments, State governments, Conservation.

The interrelationship between, and the rule of, local, state and federal government in coastal zone management is examined. Emphasis is on the federal government's involvement, including the changing role of the federal government. Some principles involved in this area are clarified. Important new directions being set in coastal zone management are discussed. A brief history of and the reasons for the level of each government's involvement is included. Effective coastal zone management requires coordination between governmental actions. The 1972 Coastal Zone Management Act (Act) was intended to enhance a coordinated effort. This Act is analyzed to define the new role of the federal government in coastal zone management, and to clarify the new directions being taken. Incentives to motivate state action, within and outside the Act, are briefly discussed. The Act will markedly improve management of coastal lands and resources. (Daniels-Florida)
W80-04583

CONGRESS AND COASTAL ZONE MANAGEMENT,
Senate, Washington, DC.
E. F. Hollings.
Coastal Zone Management Journal, Vol 1, No 1, p 115-118, Fall 1973.

Descriptors: *Legislation, *Coasts, *Shore protection, *Administrative agencies, Conferences, Federal government, Oceanography, Seashores, Legal aspects, Coasts, Oceans.

On October 5, 1972, the Coastal Zone Management Act (Act) cleared its final major hurdle - the Senate-House Conference - which paved the way for Congressional approval. Senate and House con-

currence on the Conference was unanimous, and the Act proceeded to the President where it was signed into law. Significant personal contributions were made during the Congressional deliberations. The National Academy of Sciences, including the Coordinating Committee on Oceanography in the early 1950's, accomplished much, and the 1959 Report of the Committee on Oceanography of the Academy was a landmark. A key issue in the Senate-House Conference was the amendment which had been made to the House Merchant Marine and Fisheries Committee bill. Members of the House Interior and Insular Affairs Committee succeeded in having the Secretary of the Interior named as the responsible federal official under the Act. The result of the Conference Committee deliberations, however, was that the federal coastal zone management program of assistance to states should be vested in the federal agency with the requisite technical expertise -- the National Oceanic and Atmospheric Administration. (Wilson-Florida)
W80-04584

SHORELAND ZONING IN MAINE,
Maine Univ. at Orono.
W. E. MacDonald.
Coastal Zone Management Journal, Vol 1, No 1, p 109-114, Fall 1973.

Descriptors: *Maine, *Shore protection, *Zoning, Legislation, State governments, Local governments, Land use, Environmental control, Shores, Water quality control, Administrative agencies.

In 1971, the Maine Legislature passed the Shoreland Zoning Law (Law). The Law called for mandatory shoreland zoning and subdivision controls. When the bill came out of committee the area to be so zoned had been modified downward to a narrow 250-foot strip of land adjacent to the state's lakes, rivers and ocean. To rezone all this area by July 1, 1973 was a formidable task for a state made up of independent minded towns and cities. Less than 20% of the 496 municipalities had previously adopted zoning. Maine's Shoreland Zoning Project provides technical assistance to state's towns, cities and plantations to enable them to prepare local plans and ordinances needed to comply with the Law. Some of the more important standards for guidance include: (1) protection of water quality; (2) building 75 foot setbacks; (3) leaving of trees; (4) guidelines for bulldozing; and (5) guidelines for wastes and chemicals. The guidelines have been well received locally because communities wanted simple guidelines to follow. (Wilson-Florida)
W80-04585

COASTAL ZONE MANAGEMENT - A NEW APPROACH IN CALIFORNIA,
P. M. Douglas.
Coastal Zone Management Journal, Vol 1, No 1, p 1-25, Fall 1973.

Descriptors: *California, *Coasts, *Resources development, *Permits, Legislation, Conservation, Regional development, Management, Zoning, Recreation, Recreation facilities.

California's new approach to coastal zone management - Proposition 20 - is examined. The new law created one state and six regional commissions to prepare a comprehensive, long-range plan for the conservation and use of California's coastal zone resources. The commissions exercise strict permit controls over new developments during the planning process. Discussed are the following: (1) the history of Proposition 20; (2) why California took this approach; and (3) Precedents for a Proposition 20 approach. The major objectives of the new law are outlined and discussed. Why the new law is limited to only coastal lands is explored. The new law's strength is found in its interim permit control system, the importance of which is discussed. The impact of Proposition 20's first eleven months as law is examined. There is a brief discussion on some logistical difficulties in getting the program started. Procedures used by the commissions, to reduce the permit workload and to further the new law's objectives are discussed. The commissions' significant problems are funding, enforcement, permit conditions, and consistency of permit decisions. Proposition 20's effect on property values is explored. (Daniels-Florida)
W80-04586

THE ROOTS OF U.S. FISHERIES POLICY,
Johns Hopkins Univ., Washington, DC. School of Advanced International Studies.
A. L. Hollick.
Ocean Development and International Law Journal, Vol 5, No 1, p 61-105, 1978.

Descriptors: *Fisheries, *Law of the Sea, *United States, Foreign countries, Fishing, Fish management, International law, United Nations, Conferences, Fish conservation, Anadromous fish.

The roots of the present United States (U.S.) fisheries policy and the 200-mile zone may be found in the period from World War II to the 1958 United Nations Conference on the Law of the Sea. Economic and technological developments during the war increased pressures for access to offshore living resources. Change in the international political system was also accelerated by the war. U.S. fisheries policy in the post war period was characterized by efforts to protect the status-quo's special interests. U.S. fishing groups and problem areas can be divided into three geographical areas - the Northwest Atlantic Ocean, The Northeast Pacific Ocean, and Latin American offshore waters. The Northwest Atlantic area has been plagued by a problem of overfishing by the United States, Canada and European nations. Relations with Latin American nations has been complicated by the implementation of the 200-mile economic zone. The overfishing of salmon in the Pacific has troubled relations between the United States and Japan. Disparate U.S. fishing interests have complicated the State Department's task of setting a single policy satisfactory to all U.S. interests. (Wilson-Florida)
W80-04587

CHANGES IN THE LAW OF THE SEA: IMPACT ON INTERNATIONAL FISHERIES ORGANIZATIONS,
Washington Univ., Seattle. Inst. for Marine Studies.
E. L. Miles.
Ocean Development and International Law Journal, Vol 4, No 4, p 409-444, 1977. 3 Tab.

Descriptors: *Law of the sea, *Fisheries, *International commissions, United Nations, Conferences, Fish management, Jurisdiction, Negotiations, Fishing, Economic impact, International law.

Impending changes in the Law of the Sea may have important implications for regional fishery commissions, for the Committee on Fisheries and the Department of Fisheries of FAO, and for FAO programs of technical assistance to fisheries. The trend in recent years has been for coastal states to extend their jurisdiction over fisheries. The Informal Single Negotiating Text of the Third United Nations Conference on the Law of the Sea recommends exclusive economic zones of up to a 200-mile limit. The combination of three major factors will effect the fishery commissions: (1) the trend toward coastal state sovereignty over living resources in the economic zone, including the determination of the allowable catch; (2) the imposition of coastal state controls over scientific research; and (3) most coastal states with increased authority over fisheries currently lack the capacity to manage these resources. In order to respond to these changes, FAO-sponsored commissions should assume greater management responsibilities and increase technical assistance and research. There is an obvious need to seek increased funding. (Wilson-Florida)
W80-04588

THE LAW OF THE SEA AND MANAGEMENT OF ANADROMOUS FISH STOCKS,
Simon Fraser Univ., Burnaby (British Columbia).
P. Copes.
Ocean Development and International Law Journal, Vol 4, No 3, p 233-259, 1977. 42 Ref.

Descriptors: *Law of the sea, *Anadromous fish, *Fish management, *Fish migration, International law, Oceans, Fisheries, Fishing, United Nations, International commissions, Jurisdiction, Treaties.

Unilateral declarations of 200-mile fishing zones by coastal states are likely to find recognition in new articles of international law. These probably will conform to the articles of the Single Negotiating Text, designed to protect and strengthen the fisheries rights of coastal states. The new rules may prove counterproductive as to the major salmon stocks that migrate beyond 200-mile limits. Effective protection of state-of-origin rights on the high seas will be difficult. Distant water fishing fleets will be tempted to intensify their efforts on high seas stocks. Salmon interception by neighboring states will also remain a problem. Several protective strategies and accomodations may be pursued by states-of-origin. One is to establish an international authority charged with regulating high seas fisheries. Another approach is to buy off individual states which have the inclination to fish for salmon on the high seas. Interception problems might be solved by joint management of stocking and fishing. (Wilson-Florida)
W80-04589

FROM CARACAS TO GENEVA TO NEW YORK: THE INTERNATIONAL SEABED AUTHORITY AS A CREATOR OF GRANTS,
Purdue Univ., Lafayette, IN. Dept. of Political Science.
M. E. Galey.
Ocean Development and International Law Journal, Vol 4, No 2, p 171-193, 1977. 1 Tab.

Descriptors: *Law of the sea, *Mining, *International commissions, International law, United Nations, International waters, Jurisdiction, Oceans, Treaties, Conferences, Mineral industry.

In 1970, the United Nations General Assembly adopted the Declaration of Principles on the Peaceful Uses of the Seas Beyond the Limits of National Jurisdiction. The Group of 77 has proposed an International Seabed Authority (ISA) empowered to control directly all activities in the international seabed area. The United States supported an ISA empowered to provide the opportunity for mining interests to explore and exploit resources in the area relatively free of production and other types of controls. A seldom discussed economic approach, the grants approach, may help explain the conflict between the U.S. and the Group of 77. Agreement on the ISA might occur when the different assumptions as to who is grantor and who the grantee coincide. At that point, the mix of grants and exchanges would be acceptable to both parties. If the ISA were established, it would create grants to the international community. However, the critical issue in explaining the conflict is to determine the identity of the grantor and grantee. (Wilson-Florida)
W80-04590

WATER BASED RECREATIONAL DEVELOPMENTS IN MICHIGAN - PROBLEMS OF DEVELOPERS,
Wayne State Univ., Detroit, MI.
R. W. Bartke, and S. H. Patton.
Wayne Law Review, Vol 25, No 4, p 1005-1063, July 1979.

Descriptors: *Michigan, *Lake shores, *Public access, Legislation, Water allocation(Policy), Riparian land, Recreation demand, Riparian rights, Development, Water law, Conservation.

More people than ever before desire access to waterbodies for recreational purposes. This demand intensifies pressures on the inland water resources of Michigan. High cost and decreasing availability of suitable property often preclude the development of single unit, horizontal subdivisions on waterfront lots. The system of water rights which predominates in Michigan is riparianism. Riparian rights arise by virtue of title to the bank or shore and cannot be conveyed separately. The use of private waters is limited to riparian owners. Limitations on lake shore developments and water

use include: (1) federal, state and local legislation; (2) financing; and (3) common law limitations, such as the reasonable use doctrine and narrow definitions of riparian owners. Developers have used various tools to extend lake access and use. Traditional lake shore developments include: (1) developments abutting the water; and (2) developments with backlots, such as tenancies in common, condominiums, and homeowners' associations. Developers are now providing consumers with a more complete package by the use of condominuims, cooperatives, and planned unit developments. At the same time, developers must be alert to judicial and legislative action affecting the use and improvement of waterfront property. (Wilson-Florida)
W80-04591

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
H.R. Rep No 1156, 95th Cong, 2nd Sess (1978), reprinted in 11 U.S. Code Cong and Ad News 4991 (1978).

Descriptors: *Research and development, *Water supply development, *Water resources development, Water resources research act, Impaired water use, Research facilities, Saline water, Administrative agencies, Grants, Programs, Information exchange.

The purpose of the 1978 Water Research and Development Act (Act) is to extend and modernize the organic charter controlling the water resources research and saline water conversion programs of the Department of the Interior. This Act substantially reenacts the Water Resources Research Act of 1964 and the Saline Water Conversion Act of 1971. The policy objectives are twofold. First, that general water resources research programs and saline conversion programs have separate sources in law. Second, that all authorizations for funding will be on a two-year cycle. There are four titles: Title I - Water Resources Research and Development; Title II - Water Research and Development for Saline and other Impaired Waters; Title III - Technology Transfer and Information Dissemination; and Title IV - General Provisions. The Committee on Interior and Insular Affairs adopted one amendment which, among other changes, converted all appropriations authorizations to specific amounts. The inflationary impact of the Act will be minimal and will be offset by its affirmative benefits. The Committee on Interior and Insular Affairs will maintain continuing oversight of the programs authorized. The Assistant Secretary of the Interior filed on executive communication with the Speaker of the House, explaining the Act and recommending its passage. (Wilson-Florida)
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
Act of Oct 17, 1978, Pub L. No 95-467, 92 Stat 1305, 11 U.S. Code Cong and Ad News (1978) (codified at 42 U.S.C. 7801 et seq).

Descriptors: *Research and development, *Water resources development, *Water supply development, Impaired water use, Grants, Saline water, Administrative agencies, Research facilities, Information exchange, Programs, Water resources research act.

The purposes of the 1978 Water Research and Development Act (Act) are to provide a water supply to meet the nation's needs, to preserve water resources, and to promote research and conservation. In Title I - Water Resources Research and Development - the Secretary of the Interior is authorized to assist in carrying on the work of a qualified water resources research and technology institute in each state. These institutes shall submit annual reports to the Secretary. The Secretary is charged with the proper administration of this title, and may prescribe such rules and policies as are necessary to carry it out. In Title II - Saline and other Impaired Waters - the Secretary is authorized to conduct and promote research to develop effective methods for conversion of impaired water into water for beneficial uses. The Secretary may conduct cooperative agreements with non-federal utilities and governmental entities. In Title III - Technology Transfer and Information Dissemination - the Secretary is authorized to transfer research and development results to other organizations for further development. Further, the Secretary is authorized to maintain a national center for the dissemination of water resources research information. To carry out the program funds are appropriated on a cost-sharing basis. (Wilson-Florida)
W80-04593

WATER RESOURCES DEVELOPMENT ACT OF 1978.
Hearings Subcomm on Water Resources, Comm on Public Works and Transportation, U.S. House, June 20,21,22 and 27, 1978, Serial No 95-60, p 518.

Descriptors: *Flood control, *Navigable waters, *Water resources development, Floods, Navigation, Navigable rivers, Dredging, Economic impact, Engineering, Engineers estimates.

H.R. 13059 was introduced in the House of Representatives on June 8, 1978 as a bill authorizing the 'construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes.' The bill then lists thirteen projects for which improvement is authorized. The bill also makes several amendments to the 1976 Water Resources Development Act. The Secretary of the Army, acting through the Chief of Engineers, is given authority to undertake many different activities in a number of geographical areas: (1) the control of river and harbor ice; (2) the construction of bank protection works; (3) the implementation of flood control measures in general; and (4) the performance of intermittent dredging to remove shoals. The bill also discusses costs of the various projects and the percentage that will be paid by the federal government. The report of the daily hearings on the bill is extremely extensive. The Act is to be cited as the 'Water Resource Development Act of 1978.' (Tabano-Florida)
W80-04594

KANSAS WATER RIGHTS: MORE RECENT DEVELOPMENTS,
Kansas Supreme Court, Topeka. Disciplinary Administrator.
A. Windscheffel.
The Journal of the Kansas Bar Association, Vol 47, No 3, p 217-223, Fall 1978.

Descriptors: *Consumptive use, *Kansas, *Water rights, Riparian rights, Legal aspects, Ground water, Indian reservations, Damages, Remedies, Eminent domain.

Summarized are recent court decisions and legislation affecting surface and groundwater rights in Kansas. Emerging from the 1978 session is Senate Bill 523. This Act requires all persons claiming vested rights for the beneficial use of water, other than domestic uses, which have not been determined pursuant to a previously repealed statute shall file a verfied claim with the chief engineer by July 1, 1980. With few exceptions, vested rights to water in Kansas within the scope of this Act will be resolved after the above date. A preliminary analysis of several cases involving damages sought for unlawful water collection and diversion presents an apparent conflict. The court appears confused over when damage has accrued, and when the statute of limitations begins to run in such actions. Injunctive relief in cases of water pollution is also analyzed. There is an apparent need to harmonize statutory law with present conceptions, needs, and changing conditions in Kansas. (Schwerer-Florida)
W80-04595

INTERGOVERNMENTAL ASPECTS OF WATER TRANSFER IN IDENTIFICATION AND ASSESSMENT OF FEDERAL AND INTERSTATE ISSUES AND CONSTRAINTS,
Oklahoma State Univ., Stillwater. Dept. of Political Science.
J. W. Westphal, and J. J. Lawler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173578, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute. Oklahoma State University Technical Completion Report, April 1980. p 30, 3 Fig, 4 Tab. OWRT A-084-OKLA(1), 14-34-0001-9038.

Descriptors: *Oklahoma, Interstate, *Interstate commissions, *Interstate compacts, *Interstate rivers, River basin commissions, River basins, Texas, Kansas, Arkansas, Federal Government, Water resources development, Water supply development, River basin development, *Water transfer.

Intergovernmental aspects of water transfer from eastern to central and western Oklahoma were analyzed vis-a-vis three neighboring states (Texas, Arkansas, and Kansas). The three major objectives of the study were: to identify new proposals and developments since release of Phase I of the Oklahoma Comprehensive Water Plan; to identify major inter-state and national-state issues raised by the plan; and to assess the implications of these intergovernmental factors for implementation of the Plan. New proposals and developments include elaboration of the northern phase of the conveyance system, and the determination that conveyance of water for irrigation uses cannot be justified by economic criteria for federal water projects. Inter-state aspects include legal ramifications of four interstate compacts, and problems of coordinating planning efforts with neighboring states. Federal-state relations were considered in the context of court decisions in Arizona v. California and California v. United States; the U.S. Water Resources Council's major planning objectives; the High Plains Project of the Economic Development Administration; and the requirements of the National Environmental Policy Act of 1969. The impossibility of planning instate water development apart from a regional and inter-governmental context is stressed.
W80-04602

JOJOBA: AN ALTERNATIVE TO THE CONFLICT BETWEEN AGRICULTURAL AND MUNICIPAL GROUND WATER REQUIREMENTS IN THE TUCSON AREA, ARIZONA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 3F.
W80-04667

GROUND WATER VS. HAZARDOUS WASTES,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W80-04675

STATE AGENCY EFFORTS IN WATER CONSERVATION.
California State Dept. of Water Resources, Sacramento. Div. of Planning.
For primary bibliographic entry see Field 3D.
W80-04747

A PILOT WATER CONSERVATION PROGRAM.
California Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 3D.
W80-04749

INTERCEPTOR SEWERS AND URBAN SPRAWL,
Urban Systems Research and Engineering, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5D.
W80-04751

ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES,
Resources for the Future, Inc., Washington, DC.
F. R. Anderson, A. V. Kneese, P. D. Reed, R. B.

Stevenson, and S. Taylor.
Johns Hopkins University Press, Baltimore. 1977. 196 p.

Descriptors: *Pollution, *Pollution control, *Pollution taxes(Charges), *Pollution abatement, *Political aspects, *Economic justification, *Resources, Water pollution control, Pricing, Social aspects, Policy, Management, Economics, Equity, Costs, Cost-benefit analysis, Water pollution, Legal aspects, Natural resources.

The use of money charges to discourage environmental harm is addressed and the economic, technical, legal and political problems which need to be resolved in order to implement charge plans is discussed. Because common property resources such as air and water have not been quantitatively valued, they are treated as 'free goods' and are subject to extreme abuse by economic forces. In implementing charges, all of the complex social costs incurred by an activity should be considered. Charges and direct regulation are compared; charges are seen to be more cost effective than direct regulatory approaches. An economic rationale for charges is presented, explaining how the market system should work to allocate resources, why it does not work for environmental resources, and how and why charges would remedy the problem. Results are presented of surveys of environmental quality management schemes which employ the charges concept. Water pollution and water quality control charges include effluent charges, charges to finance collective control measures, and charges in conjunction with effluent standards. An effluent charge system in use in Czechoslovakia for 10 years is described. Monitoring systems for water and air pollution pose problems. Several basic approaches for measuring discharges are presented. Means of implementing charges through legislation and legal constraints are discussed, as well as political and institutional constraints. Any charge plan must be well designed, and must be politically feasible. Charges have sufficient potential advantage over alternatives to justify implementation. Pollution charges have advantages of administrative and economic efficiency as well as equity and should be pursued in the political arena. (Arnold-NC)
W80-04752

RESERVED WATER RIGHTS AND OUR NATIONAL FORESTS,
H. T. Brooks.
Natural Resources Journal, Vol 19, No 2, p 433-443, April 1979.

Descriptors: *Winters Doctrine, *Water law, *National forests, *Gila National Forest(NM), *Court decisions, Reserved lands, New Mexico, Timber, Water rights, Legal aspects, Federal-state water rights conflicts, Legal review, Judicial decisions.

The case of United States vs New Mexico (1978) is the most recent modification by the Supreme Court of the 'Winters Doctrine,' which provides that federally reserved lands have sufficient accompanying water rights to accomplish the purpose for which the lands were reserved. This case clarified the doctrine by holding that the Gila National Forest in southwest New Mexico has reserved water rights only for the primary purposes for which it was established, but not for any secondary purposes. The primary purposes recognized by the Court for National forests are furnishing a continuous supply of timber and securing favorable water flows. The history of the Winters Doctrine dates back to the 1899 case U.S. vs Rio Grande Dam and Irrigation Company but the first real articulation of the doctrine came in its namesake, Winters vs. U.S. in 1908. The doctrine was extended through numerous subsequent cases. The effects of the most recent case have been to reduce the quantity of reserved rights which may be claimed by the federal government for national forests, and to establish that water for other primary purposes must be obtained by the U.S. from the state or through the power of eminent domain. Also, all future permittees of the national forests will be required to adjudicate their rights according to state law. Finally, this decision may be indicative of a new attitude toward the Winters Doctrine as it applies to national forests. (Iervolino-NC)
W80-04754

CONFLICTS IN ATTAINING NATIONAL GOALS FOR BOTH WATER QUALITY AND ENERGY PRODUCTION,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resources Dept.
For primary bibliographic entry see Field 6D.
W80-04755

A SYSTEMS RESOURCES APPROACH TO CITIZEN PARTICIPATION: THE CASE OF THE CORPS OF ENGINEERS,
North Carolina State Univ. at Raleigh. Dept. of Political Science.
T. D. Edgmon.
Water Resources Bulletin, Vol 15, No 5, p 1341-1352, October 1979. 29 Ref.

Descriptors: *Citizen participation, *Water resources, *Planning, *Corps of Engineers Urban Studies, *Decision making, *Administrative decisions, Administration, Institutions, Management, Project planning, Political aspects, Atlanta(GA), Albuquerque(NM), Pittsburgh-Wheeling(PA).

Citizen participation is identified as a process for decentralizing administrative decisions, making agencies 'responsive' to grass roots or local needs and values. But while citizen participation has the potential to facilitate an alteration in administrative decisions, it is not sufficient in itself to affect this change. Alterations in administrative decisions require the alteration of agency goals. The goal process is the product of coalition formation and bargaining. Therefore, citizen participation is effective only if it allows for the participation of organized groups with linkages to policy areas where other resources necessary for the maintenance of the organization are allocated. In the Corps of Engineers Urban Studies Program guidelines defined a citizen participation process going beyond the traditional public hearings format; procedures were to be established for developing public interaction in the planning process. This planning process was observed in three Corps districts: Atlanta, Pittsburgh-Wheeling, and Albuquerque. In Atlanta, substantive citizen-initiated issues find a way into the planning process, while in the other two study areas they do not. These outcomes can be attributed to Corps organization and the regional institutional environment of each of the districts. The study of these three districts illustrates the necessity of the citizen participation approach which assumes that in order to be able to exercise influence in goal setting, a group must be able to influence the flow of resources into the organization. (Iervolino-NC)
W80-04756

COASTAL STATES HAVE CONTROL OF COASTAL RESOURCES,
C. G. Lackmann.
Natural Resources Journal, Vol 19, No 2, p 393-397, April 1979.

Descriptors: *Coastal resources, *Water rights, *Channel Islands National Monument(CA), *Beds, *Legal aspects, *Court decisions, California, Submerged Lands Act of 1953, Paramount rights, Coasts, Islands, Continental Shelf, Legislation, Judicial decisions, Water.

A recent decision in the U.S. Supreme Court, United States vs. California (1978), held that the economically valuable waters and submerged lands within one mile of the Channel Islands National Monument belong to California, not the federal government. This holding will have a major impact on the coastal industry around the United States. The Channel Islands National Monument consists of most of the Santa Barbara and Anacapa Islands located west of Los Angeles and lying between Santa Cruz Island and Santa Catalina. The Court's reasoning was based on the Submerged Lands Act of 1953 which gives the states ownership and control of all coastal lands and waters claimed by the federal government under the doctrine of paramount rights. The particul lands and waters in question possess substant economic value. Actions by California to attem to lease these lands for oil, gas and mineral exp ration led to the case. The instant case involv commercial harvesting of giant kelp, Macrocyst The decision in this case indicates a policy esta lished by Congress and enforced by the Court placing highly valued coastal resources under co trol of the states. (Iervolino-NC)
W80-04757

COORDINATING LAND AND WATER US PLANNING FOR SOUND RESOURCE MA AGEMENT,
Florida Univ., Gainesville.
F. E. Maloney.
Water Supply and Management, Vol 2, No 3, 253-263, 1978.

Descriptors: *Land use, *Land managemen *Water pollution control, *Water, *Federal Wat Pollution Control Act of 1972, *Planning, *Wat resources planning, Pollutants, Effluents, Sewag treatment facilities, Florida, Wat management(Administrative), Water qualit Water use, Water resources, Legislation.

Land use planning and management is the onl cost-effective means for controlling pollutants an should be coordinated for regulatory efficiency The Federal Water Pollution Control Ac (FWPCA) Amendments of 1972 established thre water pollution control programs: (1) Nationa Pollutant Discharge Elimination Syste (NPDES); (2) a system of grants for funding wast water treatment facilities; and (3) a complex syste of three interrelated planning programs. NPDES designed to impose effluent standards and limita tions by requiring permits for the discharge of a pollutants from point sources into navigabl waters. The second program of grants is an at tempt to aid municipalities in meeting the standard set for sewage treatment. The three interrelate planning programs include funding of municipa treatment facilities under Section 201 of the Act basin planning under Section 303(e); and Sectio 208 areawide waste treatment plans. In Florid land and water use planning depend on essentiall separate regulatory systems. Land development i regulated by a combination of the Environmenta Land and Water Management Act and loca zoning regulations. Water is managed by the re gional water management districts establishe under the 1972 Florida Water Resources Act These two systems are intended to complemen one another but there are serious inefficiencie attributable to the lack of statutory consolidation (Iervolino-NC)
W80-04761

REFLECTIONS ON GROUND WATER MAN AGEMENT,
California State Water Resources Control Board Sacramento.
For primary bibliographic entry see Field 4B.
W80-04762

THE WATER GRID CONCEPT,
California State Dept. of Water Resources, Sacramento.
R. R. Reynolds.
Water Supply and Management, Vol 2, No 2, p 147-157, 1978.

Descriptors: *Water grid, *Water utilization, *Water resources development, *Water distribution, *Water management, Water supply, Water demand, Water supply development, Water delivery, Planning, Administration.

The phases in the history of water development are: (1) development of surface-water supplies; (2) development of groundwater supplies; (3) coordination of use of surface- and groundwater supplies; (4) water conveyance facilities; and (5) management of use of water. A water grid should have the following characteristics: (1) be a conveyance system; (2) have alternative sources and routes; (3) have interconnecting links; (4) have sufficient con-

veyance capacity to meet peak demands as they occur with some excess capacity; (5) be connected to, and convey water from, all sources including those under the various phases of the hydrologic cycle and those where water is made available by technological processes such as desalination; (6) operation of the facilities of the grid system could be coordinated and there could be an integrated management. The water grid would link the water sources to the areas of water demand. The most significant aspects are large interbasin and interregional aqueducts, and central coordination and management. Possible arrangements to give operational flexibility include exchange of water and capacity in reservoirs; exchange of water and capacity in aqueducts; power exchange; power and water banking; exchange of use of facilities; on-peak and off-peak operation of generation and pumping facilities; operation to maximize power production and operation to maximize water yield; controlled volume concept of aqueduct-operation; long-range forecasts; computer studies; and centralized operation control. (Iervolino-NC)
W80-04768

IMPACT OF ENERGY DEVELOPMENT ON THE LAW OF THE COLORADO RIVER,
G. D. Weatherford, and G. C. Jacoby.
Natural Resources Journal, Vol 15, No 1, p 171-213, January 1975.

Descriptors: *Colorado River, *Water allocation(Policy), *Energy, *Water demand, Reclamation, Agriculture, Water rights, Water law, Resources development, Water quality, Environmental effects, Water supply.

Profound changes are now occurring in the Colorado River Basin. New societal demands for water are on a collision course with vested legal rights and past commitments. The exploitation of fossil fuels in the area poses great problems for the traditional paramount concerns of reclamation and agriculture. The 'law of the river' is actually a composite of many statutes, compacts, court decisions, contracts, regulations and administrative rulings. Generally speaking, the flow of the Colorado River is divided among users on the basis of beneficial consumptive use. The allocation system operates at four levels: international, interregional, interstate, and intrastate. Legal problems on the river are partially the function of changes in the ratio of water supply to water demand, with a rising water demand curve. The scale of dislocation and change expected over the coming decades can be handled by the legal system through water conservation and the acquisition or condemnation of water rights. Vested rights will be subject to increased regulation in order to effect needed changes. (Wilson-Florida)
W80-04775

IMPLICATIONS FOR THE FUTURE: DESIGN OF VIABLE INTERNATIONAL INSTITUTIONS,
Mexicano Inst. de Estudios Diplomaticos.
L. C. Sepulveda.
Natural Resources Journal, Vol 15, No 1, p 215-221, January 1975.

Descriptors: *International Boundary, *Water Commission, *Colorado River, *Boundary disputes, Treaties, Mexico, United States, Water rights, International commissions, Border iffigation, International Law, Water demand.

Upon approval by both governments, Minute 242 of the International Boundary and Water Commission of August 30, 1973, became an executive agreement which represents a satisfactory arrangement concerning the use of the waters of the Colorado River. This instrument reveals the possibility of reaching agreement in other conflicting areas which may arise between Mexico and the United States because of the waters of that river. The growing scarcity of waters throughout the course of the Colorado River, the constant increase of use of the upstream waters, the continuous absence of rains, and the overestimation of flow all indicate that a problem could arise between the two countries. The underground waters along the border may also be a problem in the future. Thus, adequate international institutions should be provided for the administration of discrepancies and for the avoidance of conflict. There exist between the United States and Mexico sufficient bilateral and multilateral instruments for the amicable adjustment of controversies, especially through arbitial means. Fundamental to a solution to disputes should be the International Boundary and Waters Commission. (Wilson-Florida)
W80-04776

THE MANAGEMENT OF INTERNATIONAL BOUNDARY WATERS OF CANADA AND THE UNITED STATES: A COMPARATIVE STUDY,
Cornell Univ., Ithaca, NY. Water Resources and Marine Sciences Center.
L. B. Dworsky.
Natural Resources Journal, Vol 15, No 1, p 223-227, January 1975.

Descriptors: *Boundary disputes, *International Joint Commission, *Great Lakes, Treaties, United States, Boundaries(Surfaces), Canada, International Law, Foreign countries, Navigable waters.

Canada and the United States share a continuous boundary 3,600 miles in length. Since the 1909 Boundary Water Treaty (Treaty), the International Joint Commission has been actively engaged in helping to resolve water related disputes. Some of these cases were readily amenable to solution; others, like the problems in the Columbia River Basin, were more complex; and many of the Great Lakes' problems have not yet been solved. Since 1909, no substantial review has been made of the International Joint Commission, nor has substantial consideration been given to improving the management of the Great Lakes. The Treaty gives the Commission responsibility in two general areas. The first area is the approval or disapproval of all proposals for use, obstruction, or diversion of boundary waters. The second responsibility is to investigate and make recommendations on specific problems referred to it by either government. It would appear to be very useful to consider the formation of another commission for the Mexican-United States boundary waters. (Wilson-Florida)
W80-04777

GUARDING THE TREASURES OF THE DEEP: THE DEEP SEABED HARD MINERAL RESOURCES ACT,
D. W. Proudfoot.
Harvard Journal on Legislation, Vol 10, No 4, p 596-620, June 1973.

Descriptors: *Law of the Sea, *Resources development, *Mineral industry, Regime, Conservation, Mining, International law, Treaties, Exploitation, Beds under water, International waters.

As a response to the need for clarification and development of maritime mineral resources law, the Oceans Policy Statement was promulgated by the Nixon Administration. Part of this statement calls for an interim regime which would allow continued seabed exploration and exploitation beyond the present limits of national jurisdiction, pending establishment of an international regime. In response to this oceans policy, the Deep Seabed Hard Mineral Resources Act (DSHMRA) was introduced, but never voted on. The problem of establishing an interim regime for hard minerals is addressed. Whether the DSHMRA is a proper response to this problem is assessed. International law has not kept abreast of the seabed's mineral potential. The United States is committed to developing deep seabed resources pursuant to an international regime. The mining industry's position is one of immediate mineral development. The Mineral Resources Act (MRA) is their proposal which would establish a mandatory system of first-come-first-served licensing for hard mineral mining. The MRA accomplishes none of the objectives that a proper response to the problem should, but, if adopted in modified form, it would be a useful instrument of national policy. (Daniels-Florida)
W80-04778

COASTAL CONTROLS IN CALIFORNIA: WAVE OF THE FUTURE,
R. C. Breeden.
Harvard Journal on Legislation, Vol 11, No 3, p 463-508, 1974.

Descriptors: *California, *Coasts, *Shore protection, Legislation, Permits, Regulations, Programs, Project planning, Management, Protection, Environmental control.

In response to a perceived manmade threat to the natural characteristics of the California coastal zone, a citizen-sponsored coastal initiative, the 1972 California Coastal Zone Conservation Act (Act) was enacted. The Act has three basic objectives: (1) to establish a policy of coastal protection and environmental concern; (2) to create interim controls on development through a permit system; and (3) study the needs of the coastal zone and recommend a plan for long-term management of the coast within 4 years. The Act's provisions are analyzed; the results of its operation during the first 16 months are examined; and its legal implications are considered. Briefly examined are the unique power, duties, membership requirements and responsabilities of the enforcement commissions. The permit control system is very important in the short-run. Early problems have been encountered, most significantly the enormous backlog of permit applications. Instances of permit denials and conditional grants are examined. The planning process in operation is examined. While some success has been achieved, long-run coastal control will fail, if the immediate pressures of permit regulation divert the commissioners from designing the best possible plan. (Daniels-Florida)
W80-04779

INTERNATIONAL LAW AND MARITIME JURISDICTION IN RELATION TO SEA RESOURCES: THE CASE OF FISHING IN PERU,
R. J. Payne.
Howard Law Journal, Vol 18, No 2, p 361-384, 1974.

Descriptors: *Fisheries, *Jurisdiction, *Law of the sea, Resources, Resource development, International law, Technology, Economic justification, Fishing, Exploitation.

Advanced technical knowledge enables man to explore and develop what once was beyond his imagination. These advances affect law and relations, and call for revisions and adjustments in international law. With advanced technology, a new emphasis is placed on the ocean as a food source. This challenges traditional territorial water limitations, such as the three-mile limit, and cooperation in exploiting marine resources, especially fisheries. Nations lacking this technology, especially Peru, are unable to compete with technologically advanced nations for fisheries resources, which are essential to their development. The relation of fisheries to territorial waters and maritime jurisdiction is examined. Fishing has always played a major role in the economic welfare of many maritime states, especially Peru. Peru's claim to a 200-mile jurisdictional zone can be seen as a necessary action to prevent uncontrolled exploitation of fish by technologically advanced nations. Economic conditions within countries determines the nature and content of international law to a large extent. International law must suit present conditions. The three-mile limit grew out of circumstances no longer prevailing. (Daniels-Florida)
W80-04780

ENFORCING THE FEDERAL WATER RESOURCE SERVITUDE ON SUBMERGED AND RIPARIAN LANDS,
B. H. Johnson.
Duke Law Journal, Vol 1977, No 3, p 347-388, May 1977.

Descriptors: *Federal Water Pollution Control Act, *Rivers and harbors act, *Riparian land, *Easements, Regulation, Water resources, Administrative agencies, Public access, Legislation, Regulation, Navigable waters, Public rights.

Congress has customarily substantiated public water resource rights by enacting federal restrictions on private activities in or around waters and adjacent wetlands. Enforcement of federal controls is difficult and complex because of a wide variety of geographical settings, policy considerations, equities and public interests. Past enforcement efforts were on an ad hoc basis. Recent developments show a move toward programmatic approaches to enforcement. Current developments in the federal enforcement effort are examined. Congressional restrictions imposed on owners of submerged and riparian lands by the 1899 Rivers and Harbors Appropriation Act and the 1972 Federal Water Pollution Control Act Amendments are generally discussed. These acts effectively burden submerged and riparian lands with a federal water resource servitude. Administrative enforcement efforts, including cease-and-desist orders, self-help remedies, and judicial enforcement efforts, allowing for civil and criminal penalties and injunctions, are explored. While a broad range of remedial measures are at the federal government's disposal, the complexity of the enforcement task requires additional remedies. Enforcement should begin with the administrative process, and agencies should be provided with necessary remedial measures. (Daniels-Florida)
W80-04781

MUSING ON THE BOTTOM: ECONOMIC AND LEGAL IMPLICATIONS OF THE UNITED STATES' PROPOSED DRAFT UNITED NATIONS CONVENTION ON THE INTERNATIONAL SEABED,
Lewis and Clark Coll., Portland, OR.
E. J. Brunet.
University of Illinois Law Forum, Vol 1974, No 2, p 251-284, 1974.

Descriptors: *Beds under water, *Law of the sea, *Resources development, Legal aspects, Economic impact, International waters, Oceans, Resources, Mineral industry, United Nations, International commissions.

No legal norms governing use of the ocean's seabed exist. There is an immediate need for consideration of institutional arrangements to control marine resource exploitation. On May 23, 1970, President Nixon announced a revolutionary ocean seabed policy for the United States (U.S.) that was subsequently submitted to the United Nations (U.N.). This proposal would provide the legal structure governing almost three-quarters of the earth's area, with corresponding monumental political and economic significance. The core of the U.S. proposed convention is its novel ownership provision. The International Seabed Area would be open to use by all states, considered the common heritage of mankind. The proposal creates an international political entity and U.N. affiliate, the International Seabed Authority, to govern ocean seabeds. An exploitation license, granted by the Seabed Authority, would be a prerequisite to seabed mining. An analysis of the U.S. proposal identifies certain inherent inefficiencies. (Wilson-Florida)
W80-04782

FEDERAL ENVIRONMENTAL LITIGATION IN 1976: THE FEDERAL WATER POLLUTION CONTROL ACT,
K. M. Hunciker, and V. Pagano, Jr.
Harvard Environmental Law Review, Vol 1, p 59-101, 1976.

Descriptors: *Waste water treatment, *Federal water pollution control act, *Water quality standards, Judicial decisions, Legal aspects, Federal government, Effluents, Legislation, Administrative agencies, Industrial wastes, Environmental control.

The 1972 Federal Water Pollution Control Act Amendments (Act) are a crucial element in the nation's battle against pollution. The most important litigation under the 1972 Amendments resulted from industry challenges to the federal Environmental Protection Agency's (EPA) promulgation of effluent limitation regulations for industrial wastewater discharges. The affected industries challenged EPA's authority under the Act on several grounds: (1) the issuance of binding effluent limitations; (2) the procedures under which these limitations are to be imposed; and (3) the merits of the specific pollutant limits themselves. A major requirement of the Act is that uniform effluent limitations be achieved for all industrial point sources by July 1, 1977, and July 1, 1983, based on the technology required. Delays in issuing standards, granting permits, and in judicial review of regulations have ensured that the 1977 deadline will not be met. Section 509(b)(1) provides for judicial review of the promulgated effluent limitations. Court challenges have become a major time barrier to attaining the 1977 and 1983 deadlines. (Wilson-Florida)
W80-04783

THE COASTAL ZONE MANAGEMENT ACT AMENDMENTS OF 1976,
A. C. Yahner.
Harvard Environmental Law Review, Vol 1, p 259-288, 1976.

Descriptors: *Coasts, *Shore protection, *Energy, Programs, Legislation, Federal government, Research and development, Development, State governments, Public access, Planning.

In enacting the 1976 Coastal Zone Management Act Amendments (Amendments) Congress sought to expand the Act to compensate for the effects of energy facilities on coastal areas. The Amendments establish a 1.2 billion-dollar program to aid the states in planning the location of specific facilities, in financing public projects such as schools and roads necessitated by these facilities, and in ameliorating environmental losses. The Amendments also expand the original planning program by requiring three new planning elements dealing with beach access, coastal erosion and energy facilities siting. In addition, three new funding programs are established to provide money for interstate coordinated activities, for research and technical assistance, and for acquiring access to shorefront areas. The Amendments establish a Coastal Energy Impact Fund to provide grants, loans, and guarantees for states to plan for and mitigate the impacts of new coastal energy activities. The Amendments also raise a number of questions concerning their effect on the original Act. (Wilson-Florida)
W80-04784

IMAGES AND MODELS IN THE WORLD COURT: THE INDIVIDUAL OPINIONS IN THE NORTH SEA CONTINENTAL SHELF CASES,
Sheffield Univ. (England).
J. G. Merrills.
The Modern Law Review, Vol 41, No 6, p 638-659, November 1978.

Descriptors: *Continental Shelf, *International waters, *Law of the sea, International commissions, International law, Governments, Governmental interrelations, Water law, Law enforcement, Judicial decisions.

The individual opinions in the North Sea Continental Shelf cases are examined for evidence of so-called 'images' and 'models' of international law. The cases arose out of a dispute between Denmark and the Netherlands on one side and the Federal Republic of Germany on the other, relating to the delimitation of their respective areas of the North Sea Continental Shelf. These cases decided there was no single method of delimitation obligatory in all circumstances. Delimitation was to be effected by equitable agreement. The individual opinions are discussed in considerable detail. The significance of images and models is analyzed. Images are viewed as 'conceptions of concrete situations lurking behind proposals for solutions to general problems'. Models are seen as 'the mental constructs of the world we employ to organize our thinking about international law.' Applied to the individual opinions, the different models and images are viewed as the reason for the gulf dividing contemporary theories of international law. (Tabano-Florida)
W80-04785

CURRENT ENVIRONMENTAL LAW: TAKING OR REGULATION,
R. L. Bisso.
Loyola Law Review, Vol 24, No 4, p 649-677, Fall 1978.

Descriptors: *Land use, *Coastal plains, *Shore protection, Economics, Environmental effects, Ecology, Compensation, Constitutional law, Environment, Eminent domain, Environmental control.

A conflict exists today between the pressures of economic land exploitation and the pressure to maintain environmental quality through land use legislation. The taking issue is discussed in light of recent coastal and shoreline protection regulation. The current state of the taking issue is reviewed, beginning with Pennsylvania Coal v. Mahon, and following through to the recent Penn Central Transportation Company v. City of New York. The constitutional elements of the taking issue are discussed, emphasizing the distinction between eminent domain and the police power. The regulatory trend has shifted now from an emphasis on economic values to ecological, social and aesthetic ones, and this switch is reviewed through an analysis of the 1972 Federal Coastal Zone Management Act, the Marinette County, Wisconsin Shoreline Zoning Ordinance, and the New Orleans Coastal Zone Management Plan. Three alternative solutions to environmental control are offered: (1) restrictive height, bulk and area requirements; (2) transfer of development rights; and (3) in lien payments. Legislation recognizing the difference between eminent domain and the police power could solve the problem. (Tabano-Florida)
W80-04786

EMERGING TRENDS IN THE USE OF INTERNATIONAL LAW AND INSTITUTIONS FOR THE MANAGEMENT OF INTERNATIONAL WATER RESOURCES,
Denver Univ., CO.
V. P. Nanda.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 239-261, 1976. 1 Fig.

Descriptors: *Water quality, *Water resources development, *International waters, *International law, United Nations, Water law, Water resources, Water management(Applied), Water quality control, Water sources, International commissions, Governmental interrelations.

In a recent conference, the United Nations concluded that a potential world water crisis exists. Although there appears to be sufficient water, it tends to be available in the wrong place or with the wrong quality. International law and institutions can facilitate the management of international river resources, primarily for non-navigational uses. Unilateral attempts to solve water problems are often limited, since many nations lack adequate data and skill to develop water systems with likely wasteful duplication of effort. Concerted effort is especially necessary for internationally interconnected water resources. General conventions of nations have been held to adopt treaties and statutes. There have also been multilateral, regional, and bilateral conventions, accounting for some 300 agreements between and among states. A large number of intergovernmental organizations have also been actively involved with water resource problems. Scholarly and professional organizations have contributed studies of international watercourses. Emphasis should be taken off sovereignty when dealing with the uses of international waters, and placed upon the interests of the international community as a whole. (Tabano-Florida)
W80-04787

THE MANAGEMENT OF LAND AND WATER USE IN THE COASTAL ZONE: A NEW LAW IS ENACTED IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill.
T. J. Schoenbaum.
The North Carolina Law Review, Vol 53, No 2, p 275-302, December 1974.

Descriptors: *Coastal plains, *Coastal structures, *Land use, *Shore protection, Resources, Admin-

istrative agencies, Water utilization, Permits, Governmental interrelations, Management, Environmental controls, *North Carolina.

In 1974, North Carolina passed the Coastal Area Management Act (Act), initiating a comprehensive program for the management of the land and water resources in its coastal zone. Its major objectives are an instrumental use of law rather than a mere technical statement, and the delegation of substantial discretionary powers to administrative agencies and local government units. Although the process of policy formulation was influenced by federal developments, such as the 1972 Coastal Zone Management Act, the state's law has proceeded independently from the federal effort. The area covered by the Act is extremely broad. The Act institutes comprehensive land and water use planning for the coastal area. Certain lands and waters are designated areas of environmental concern in which no development may be undertaken without a permit. Variances are allowed upon a showing of unnecessary hardship, and certain exemptions and exclusions are allowed. Two procedures for judicial review are available, and public participation in decision-making is required. The local character of the administrative agency, the lack of legal requirements to assure planning implementation, and the exemptions given could subvert the Act's intended operation. (Tabano-Florida)
W80-04788

ONCE-RELEASED IRRIGATION WATERS: LIABILITY AND LITIGATION,
H. Meshorer.
Montana Law Review, Vol 36, No 1, p 14-28, Winter 1975.

Descriptors: *Irrigation effects, *Drainage water, *Seepage control, *Remedies, Legislation, Federal jurisdiction, Judicial decisions, Irrigation engineering, Reclamation, Legal aspects, Irrigation, Water law.

There has been an inevitable outgrowth of the widespread use of irrigation in the western United States. This is litigation regarding damage caused by seepage or drainage of excess waters from government reclamation projects onto adjoining lands. The problems remain unavoidable because of the basic engineering or irrigation, and unsettled due to the relative lack of case law on the subject. Problems are further complicated by the various notions of ownership and resultant liabilities. The most commonly used remedy for the injured landowner is the Federal Tort Claims Act. As an adjunct to tort liability, the doctrine of res ipsa loquitur may be applied. Liability apart from negligence may still exist in the form of the constitutional claim of a taking of property for a public use without just compensation. The remedies available to the landowner whose property is damaged by seeping waters are plainly inadequate. One alternative might be a decision to recognize a form of absolute liability. (Wilson-Florida)
W80-04789

THE ENFORCEMENT OF FEDERAL RECLAMATION LAW IN THE WESTLANDS WATER DISTRICT: A BROKEN PROMISE,
M. L. Frampton.
University of California, Davis, Law Review, Vol 13, No 1, p 89-121, Winter 1979-80.

Descriptors: *Federal reclamation law, *Federal project policy, *Water districts, *California, Reclamation, Agriculture, Irrigation water, Legal aspects, Federal government, Administrative agencies, Water allocation(Policy).

In California's San Joaquin Valley lie more than a half-million acres of rich agricultural land. This ground is made bountiful by irrigation water from the federally constructed San Luis Unit of the Central Valley Project. One consideration for procuring water subsidies from the federal government is the landowners' continuing compliance with federal reclamation statutes. These statutes limit the amount of water an individual may obtain, and require recipients to live on or near their farmland. The purposes of the reclamation law have been continually thwarted in the Westlands Water District. This District supports a mere 216 large farm operations. Small farmers have been frustrated in their attempts to purchase land in the Westlands Water District. Small farmers have challenged the federal administration of reclamation law. Groups have sought injunctions to prevent further excess land sales, pending promulgation of regulations regarding such approvals. However, without a meaningful lottery provision or a realistic residency figure, the new rules would not prevent large group transactions and insider deals that exclude the average family farmer. (Wilson-Florida)
W80-04790

SOIL CONSERVATION AND WATER POLLUTION CONTROL: THE MUDDY RECORD OF THE UNITED STATES DEPARTMENT OF AGRICULTURE,
Nebraska Univ., Omaha.
C. L. Williams.
Boston College Environmental Affairs Law Review, Vol 7, No 3, p 365-421, 1979.

Descriptors: *Soil conservation, *Soil erosion, *Water pollution control, *Agricultural runoff, Land use, Agriculture, Federal water pollution control act, Water quality, Administrative agencies, Federal government, Water pollution sources.

Under provisions of Section 208 of the 1972 Federal Water Pollution Control Act Amendments, every state must submit a Water Quality Management Plan. This Plan covers so-called non-designated areas within the state, which must be approved by the federal Environmental Protection Agency (EPA). Since the vast majority of agricultural land in the United States lies in these non-designated areas, virtually all agricultural land may potentially become subject to federally mandated water pollution regulations. There are serious efforts being made to have the administration of Section 208 removed from EPA, as it applies to agriculture, and placed instead in the Department of Agriculture (USDA). With a prominent role in the control of agricultural non-point source pollution virtually assured for the USDA, it is important to examine that agency's past performance regarding the limitation of soil erosion. The USDA's shortcomings in soil conservation have occurred in three areas: (1) program goals; (2) program content; and (3) program administration. Finally, difficulty arises from the nature of the erosion problem itself, for erosion control programs require a great deal of flexibility. (Wilson-Florida)
W80-04791

THE FEDERAL WATER POLLUTION CONTROL ACT - INDUSTRIAL CHALLENGES TO EFFLUENT LIMITATIONS,
J. E. McKinnon.
Boston College Environmental Affairs Law Review, Vol 7, No 4, p 545-566, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Waste water(Pollution), Water pollution, Administrative decisions, Effluents, Administrative agencies, Legal aspects, Regulation, Decision making, Discharge(Water).

Under the 1972 Federal Water Pollution Control Act Amendments (Act) every industry that discharges waste water must meet effluent limitations promulgated by the federal Environmental Protection Agency (EPA). This mandate has spawned legal challenges to effluent limitations. The different types of industrial challenges to effluent limitations are described. The three main categories of challenges are procedural, statutory and substantive. Procedural challenges concern the EPA's failure to satisfy fair notice requirements. Statutory challenges involve attacks on the EPA's interpretation of the Act. Substantive challenges concern the EPA's judgment in developing effluent limitations. The legal standards that these effluent limitations must meet in order to withstand such judicial challenges are outlined. Strict enforcement of the fair notice requirement is the best way to ensure fair regulation and decrease procedural challenges. Substantive challenges may be expected to make up the bulk of future challenges. If the EPA can show, through the administrative record, that adequate consideration was given to all relevant factors and that it has noted on correct data in setting effluent limitations, these challenges will likely fail. (Daniels-Florida)
W80-04792

THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978: BALANCING ENERGY NEEDS WITH ENVIRONMENTAL CONCERNS,
G. L. James.
Louisiana Law Review, Vol 40, No 1, p 177-206, Fall 1979.

Descriptors: *Continental shelf, *Oil fields, *Oil pollution, *Resources development, Gasoline, Oil, Environment, Leases, Sites, Governmental interrelations, Oil spills, Management, Drilling.

In 1977 Congress amended the Outer Continental Shelf Lands Act (Act) in order to expedite the development and production of continental shelf oil and gas, and to provide adequate protection to the coastal environment. This comment addresses these amendments by first presenting the Act's background and other major federal regulatory legislation are discussed. The amendments are discussed as they relate to three different stages of the leasing process. Stage one, site selection, deals with different factors involved in the selection process. Exploration and development is also mentioned, with a review of state and local government participation in the program. Stage two, management, covers the suspension and cancellation of leases, air emission standards, and improvement of drilling technology. The third stage, enforcement, reviews the role of the federal agencies, liability, and damages recovery in the event of an oil spill. A balance between the need for future energy supplies and the importance of environmental protection must be struck in order that the United States may depend less on foreign oil sources and yet preserve its aesthetic quality. (Tabano-Florida)
W80-04793

NEED FOR A UNIFORM PUBLIC - PRIVATE BOUNDARY: APPLICATION OF THE HIGH WATER BOUNDARY TO INLAND NAVIGABLE LAKES,
K. S. Beaumont, and L. Libby-Nelson.
University of California, Davis, Law Review, Vol 12, No 1, p 125-164, March 1979.

Descriptors: *Boundaries(Property), *Boundary disputes, *High water mark, *Navigable waters, Riparian land, Riparian rights, Compensation, Water injury, Water law, Water level fluctuations, Flooding, Submergence.

Private riparian owners and the state of California are currently arguing over the boundary line separating state from private ownership on navigable lakes. The state asserts title to the high water mark while the private owners claim to the low water mark. A resolution of the public-private boundary conflict in California's navigable lakes is proposed. The ordinary high water line is asserted as the true boundary. The background and use of this line is thoroughly discussed. Explicit adoption of a high water boundary would not result in a compensable taking of private property. Artificial regulation of the water level in relation to the boundary question is also discussed. It is felt that the boundary should follow the new high water mark, even though the state has caused the increase. The issue of whether the state should compensate owners for riparian land which becomes submerged or flooded due to state action is also considered. (Tabano-Florida)
W80-04794

WRECK REMOVAL; STATUTORY RESTRICTIONS; RIVERS AND HARBORS ACT,
A. J. Blank, Jr.
Tulane Law Review, Vol 53, No 4, p 1299-1327, June 1979.

Descriptors: *Rivers and Harbors Act, *Coast guard regulations, *Water pollution control, Judi-

cial decisions, Legislation, Ships, Remedies, Federal government, Watercourses(Legal aspects), Navigation, *Shipwreck removal.

Although the present federal Wreck Statute governing wreck removal has been in existence since 1899, the first significant analysis of it by the Supreme Court did not occur until 1967 in Wyondotte Transportation Co. v. United States. Recent court decisions have been in favor of the rights and remedies of the government against both the negligent wreck owner, the negligent non-owner who caused or contributed to the wreck sinking. Although the Wreck Act (Act) is not a model of clarity, it is evident that none of its sections include any personal remedies; rather they include only property remedies. Section 15 of the Act has been construed to place on the owner of a wreck, whether negligent or not, a continuous duty to locate and mark his wreck. An element of uncertainty has existed as to when and if owners were relieved of this duty by the intervention of the Coast Guard. The condemnation in the Wyandotte case of negligent parties, and its rejection of their right of abandonment, exposes such parties to unlimited personal liability for removal costs. (Wilson-Florida)
W80-04795

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
C. B. Myhrum.
Boston College Environmental Affairs Law Review, Vol 7, No 4, p 567-627, 1979.

Descriptors: *Wetlands, *Federal Water Pollution Control Act, *Water quality control, Environmental control, Regulation, Legislation, State governments, Navigable waters, Rivers and Harbors act, Environment, Federal government.

Wetland protection is viewed as a vitally important priority in the effort to restore and maintain water quality and preserve natural hydrologic cycles. The problem of arriving at an exact definition of wetlands and their importance in the ecosystem are discussed. An analysis of certain state regulatory efforts shows the shortcomings of state pollution control strategies and the necessity for federal regulation in this area. A historical perspective covers the term 'navigable waters' and the 1899 Rivers and Harbors Act. The enactment of Section 404 of the Federal Water Pollution Control Act is discussed emphasizing statutory drafting mistakes that caused a dispute between the Environmental Protection Agency and the Army Corps of Engineers. The resulting litigation brought about an expansion of Section 404. The elements of this new program especially significant to wetland protection is discussed. The Congressional activity involved in the evolution of Section 404 is examined with emphasis on its expansive revisions. This growing awareness of the value of wetlands will aid in maintaining an ecologically balanced environment. (Tabano-Florida)
W80-04796

THE MUNICIPAL PROGRAM OF THE CLEAN WATER ACT: 1978 ADMINISTRATIVE IMPLEMENTATION,
T. S. James, Jr.
The Harvard Environmental Law Review, Vol 3, p 326-346, 1979.

Descriptors: *Municipal wastes, *Construction costs, *Treatment facilities, Grants, Discharge(Water), Federal government, Public utilities, Treatment, Governmental interrelations, Cost analysis, Technology.

In 1978, the federal Environmental Protection Agency (EPA) promulgated regulations to implement the 1977 Clean Water Act (Act). These regulations embody important insights gained from the EPA's evaluation of the municipal program. The program goals were changed to extend the statutory deadline for all municipal point sources and to provide an exception for discharges into marine waters. The Construction Grants Program, which provides federal assistance for construction of publicly-owned treatment works, also underwent changes. Responsibilities were decentralized from the EPA to the states and local governments. The categories of eligible construction costs were expanded. Special Funding Programs were implemented, providing grants for innovative and alternative technology. Cost-Effectiveness Analysis Guidelines and Reserve Capacity Regulations were promulgated to promote efficiency. Combined grants were also made available to certain communities for preparing construction plans and specifications and for building the treatment works. All of these changes promote a balance of the Act's varied objectives. (Tabano-Florida)
W80-04797

REPORT TO GOVERNOR JOHN A. LOVE ON CERTAIN COLORADO WATER LAW PROBLEMS,
Holland and Hart, Denver, CO.
J. U. Carlson.
Denver Law Journal, Vol 50, No 3, p 293-350, 1973.

Descriptors: *Colorado, *Prior appropriation, *Water allocation(Policy), *Water demand, Diversion, Environmental effects, Water law, Water rights, Water resources development, State government, Legal aspects, Water management(Applied).

In a semi-arid state like Colorado, the importance of water and its uses are obvious. As this resource approaches full utilization, concern that social and environmental values be protected becomes paramount. The resolution of these concerns is complicated by a system of water law rooted in the state constitution. The doctrine of prior appropriation was law in Colorado before statehood, and the constitution of 1876 confirmed prior appropriation as the state's fundamental water law. In the early development of prior appropriation law, it was clear that a judicial decree did not create the water right; the right was created by diversion of water and its application to beneficial use. The increasing demand for water and the scarcity of further unappropriated waters point to increasing market pressure on existing, decreed rights. The doctrine of prior appropriation contemplates the full use of all the state's water. The favored uses are traditional consumptions for economic development. Full consumptive use may serve goals of economic development at the expense of scenic, aesthetic and environmental values. (Wilson-Florida)
W80-04798

VESSEL-SOURCE OIL POLLUTION: LEGAL, ADMINISTRATIVE AND TECHNICAL ASPECTS OF A GLOBAL ENVIRONMENTAL PROBLEM,
R. A. Kriscunas.
Comparative Law Yearbook, Vol 2, p 237-284, 1978.

Descriptors: *International waters, *Oil spills, *Oceans, *International Boundary and Water Commission, International law, Water pollution, Oil pollution, International commissions, Legal aspects, Marine biology, Environmental effects, Environmental control.

The reader is given an understanding of the legitimate ecological issues raised by the maritime transportation of oil. An up-to-date explanation is provided of the control measures being utilized by the international community to curtail vessel-source oil pollution. The various national and regional approaches to this essentially 'extraterritorial' pollution phenomena are surveyed. Examined in detail are a variety of proposals for improving the development and enforcement of international and national standards for the prevention of vessel-source pollution. Included are the 1974 Baltic Convention, the Third United Nations Conference on the Law of the Sea, the 1973 Marine Pollution Convention, and others. Individual states lack standing to complain about all but a minimal number of water-based and land-based pollution activities. Furthermore, shipowner or even cargo-owner liability is not a deterrent to pollution. There is a need for a comprehensive ocean protection constitution. Essential elements for a proposal in the immediate future are suggested. (Schwerer-Florida)
W80-04799

PREVENTING GROUNDWATER POLLUTION: TOWARDS A COORDINATED STRATEGY TO PROTECT CRITICAL RECHARGE ZONES,
Environmental Defense Fund, Inc., Washington, DC.
J. T. B. Tripp, and A. B. Jaffe.
The Harvard Environmental Law Review, Vol 3, p 1-47, 1979.

Descriptors: *Groundwater, *Pollution abatement, *Groundwater recharge, Federal government, Federal Water Pollution Control Act, Water pollution, Water management(Applied), Legislation, Legal aspects, Water supply.

To be effective, groundwater management requires coordinated action by all levels of government and a broad arsenal of legal tools, including regulation of land use. The nature of groundwater and groundwater pollution, and the legal framework upon which control must be based are examined. Federal, state, and local legislation is analyzed, including four case studies utilizing programs based on non-degradation and recharge zone protection. The case studies illustrate both the possibilities and the difficulties of implementing such an approach. Although specific problems of assuring adequate water quantity are not addressed, the problems of pollution control measures aggravating depletion and depletion control measures worsening pollution are examined. An overall management approach to groundwater pollution is suggested, with primary responsibility for groundwater protection in the states and localities. This is based on the apparent confusion in federal programs, and the ineffectiveness of regulation under the Safe Drinking Water Act and other federally administered programs. The ineffectiveness of federal programs regulating groundwater pollution is analyzed. Possible amendments and proposals are suggested. (Schwerer-Florida)
W80-04800

6F. Nonstructural Alternatives

COASTAL ZONE MANAGEMENT - A FEDERAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-04583

SHORELAND ZONING IN MAINE,
Maine Univ. at Orono.
For primary bibliographic entry see Field 6E.
W80-04585

COASTAL ZONE MANAGEMENT - A NEW APPROACH IN CALIFORNIA,
For primary bibliographic entry see Field 6E.
W80-04586

ESTIMATING COSTS AND BENEFITS FOR NONSTRUCTURAL FLOOD CONTROL MEASURES,
Hydrologic Engineering Center, Davis, CA.
W. D. Carson.
October 1975. 115 p, 7 Fig, 18 Tab, 40 Ref.

Descriptors: *Flood control, *Floodproofing, *Non-structural alternatives, *Regulation, *Relocation, *Land use, *Cost-benefit analysis, *Evaluation, Flood protection, Flood plain zoning, Zoning, Building codes, Benefits, Project benefits, Project planning, Computer models, Computer program, Linear programming, Flood damage, Damages.

This report evaluates three nonstructural flood control measures: flood-proofing, evacuation-relocation and land use regulations. Floodproofing is an adjustment to a structure or its contents, or both, such that either water is kept from the structure or the damaging effects of water entry are

inated or reduced. Evacuation-relocation in-
ves the physical and permanent evacuation of
vities and people from the floodplain to sites
ere the flood hazard is lower. Land use regula-
attempts to direct future land use in such a
that it is consistent with the flood hazard.
imates of the cost of floodproofing would be
le by examining different designs for each
ucture and choosing the least expensive to add
the total cost. Two distinctive cost categories
be considered for evacuation-relocation: (1)
sical costs of carrying out the program, and (2)
of income occasioned by the relocation of the
ivity away from the location chosen in the
rket. The measurement of the costs of land use
ulation requires projection of future develop-
nt which will occur in the floodplain and deter-
ning what costs are incurred by excluding this
jected development from the floodplain. These
ee measures create inundation reduction benefits
lowering the damage susceptibility of individual
uctures or of the aggregate of structures on the
odplain. Intensification benefits occur when an
ivity is allowed, or induced, to intensify its
eration as a result of a flood control program.
ols for evaluating nonstructural measures in-
de (1) Hydrological Engineering Center
EC)-5C-Simulation of Flood Control and Con-
vation Systems; (2) Day-Weisz Model; (3)
TASA Simulator; and (4) HEC-DAMCAL.
ese tools are either computer programs or linear
gramming models. (Iervolino-NC)
80-04769

IE MANAGEMENT OF LAND AND WATER
E IN THE COASTAL ZONE: A NEW LAW IS
NACTED IN NORTH CAROLINA,
rth Carolina Univ. at Chapel Hill.
r primary bibliographic entry see Field 6E.
80-04788

G. Ecologic Impact Of Water Development

HEASANT USE OF WETLANDS DURING
HE WINTER AND APPLICATION OF LAND-
AT IMAGERY FOR ASSESSING WINTER
ABITAT,
uth Dakota State Univ., Brookings. Dept. of
ildlife and Fisheries.
Sather-Blair, R. L. Linder, and D. G. Moore.
vailable from the National Technical Information
rvice, Springfield, VA 22161 as PB80-170616,
ice codes: A04 in paper copy, A01 in microfiche.
ater Resources Institute, South Dakota State
niversity, February 1980. 53 p, 8 Fig, 18 Tab, 18
ef. OWRT A-062-SDAK(1), 14-34-0001-7088.

escriptors: *Wetlands, Vegetation, Remote sens-
g, Land use, *Game birds, Winter, *South
akota, *Pheasant, Infrared photography.

his study was designed to investigate (1) vegeta-
ve factors influencing ring-necked pheasant (Pha-
anus colchicus) use of wetlands during the
inter, (2) the relationship of land use practices
djacent to wetlands and the use of such wetlands
winter cover by pheasants, and (3) the feasibility
assessing wetlands as pheasant winter habitat
rough the use of remote sensing data. Fifteen
etlands in Windsor Township, Brookings
ounty, South Dakota, were randomly selected
r study to estimate their use by pheasants. Use of
over types was analyzed by using multiple regres-
on, chi-square, and t-tests. Correlation matrices
ere generated to locate significant relationships.
heasant use of wetlands was analyzed using multi-
le regression. Height was the most important
egetative factor influencing loafing site selection.
hrubs were highly preferred over other cover
ypes for loafing. Trees, phragmites (Phragmites
ommunis), and cattails (Typha latifolia) were also
sed regularly. Smartweeds (Polygonum coccin-
um), roundstem bulrushes (Scirpus acutus and
cirpus validus), and grasses were seldom used.
Density was the most important vegetative factor
nfluencing selection of roots sites by pheasants.
Most roots were in cattails while phragmites had
he greatest relative number of roots. Size of wet-
and and the presence of emergency cover around the wetland were the most important factors influencing degree of pheasant use. Wetlands consistently used by pheasants were either large dense cattail wetlands or had considerable shrub growth. The small wetlands with no shrub growth filled with snow early and were not utilized. (Wiersma-South Dakota)
W80-04544

THE COASTAL ZONE MANAGEMENT ACT AMENDMENTS OF 1976,
For primary bibliographic entry see Field 6E.
W80-04784

FEDERAL PROTECTION OF WETLANDS THROUGH LEGAL PROCESS,
For primary bibliographic entry see Field 6E.
W80-04796

7. RESOURCES DATA

7B. Data Acquisition

IN SEARCH OF WETLANDS,
R. Nyc.
Water Spectrum, Vol 12, No 2, p 17-25, Spring 1980. 9 Fig, 1 Tab, 2 Ref.

Descriptors: *Wetlands, *Surveys, *Mapping, *Terrain analysis, Classification, Systematics, Aerial photography, Remote sensing, Wildlife, Census, Swamps, Bogs, Aquatic habitats, Marshes, Fen.

Stereoscopic interpretation of high quality, small scale, aerial photography is being used to produce maps for the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI). So that the inventory will be consistent nationwide, old terms such as bogs, marshes, fens, and swamps are not used in the new classification system. The NWI system has five broad ecological systems that have hierarchical structures to describe hydrological, biological and physical aspects of wetland areas. Other elements allowed in the system include modifiers for water regime, water chemistry, soils, and man-influence. For mapping, each element in the system is assigned a letter or number and an alpha-numeric composite code is used to identify a particular wetland. Depending on the availability of base maps two types of inventory maps are being produced: large scale maps (1:24,000 or 1:62,500), and small scale maps (1:100,000). Transitional zones, areas where wetland and upland plants share common ground, are also included in the inventory. No attempt is made by the NWI to define limits of proprietary jurisdiction of regulatory agencies. To check map accuracy field review is conducted by the Corps of Engineers. The smallest wetland mapped is between one and five acres although in some areas greater detail is possible. A Wetland Analytical Mapping System is planned to produce digitized wetland information directly from aerial photographs which will be even more accurate than the current cartographic procedure. (Seigler-IPA)
W80-04507

DOWSERS WIELD WEIRD WANDS: IS IT SCIENCE, ART OR MAGIC,
R. Wolkomir.
Science Digest, p 66-71, March, 1978.

Descriptors: *Ground water, *Exploration, Remote sensing, Subsurface investigations, Electromagnetic waves.

Interest in dowsing is on the increase but many scientists remain skeptical. Several studies have put the success rate for dowsed wells and undowsed wells about the same. One study at Harvard University concluded that dowsers unconsciously move the rods themselves by minute muscular responses to subliminal geological clues to ground water. Other researchers have found that dowsers are sensitive to changes in electro-magnetic fields. However, this sensitivity does not explain other dowser claims such as the ability to locate ground water using maps, or the ability to change the direction of ground water flow. The U.S. Geological Survey, after having examined the literature and the results of scientifically controlled experiments on dowsing, has concluded that the expense of further tests of water dowsing is not justified. (Purdin-NWWA)
W80-04522

A SIMPLE DIGITAL RATE-METER FOR CURRENT METERS (NOTE),
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
M. M. Gibbs.
Journal of Hydrology (New Zealand), Vol 18, No 1, p 55-58, 1979. 2 Fig, 1 Ref.

Descriptors: *Current meters, *Automatic control, *Automation, *Instrumentation, Equipment, Design, Currents(Water), Flow, On-site investigations, Measurement, Hydrology, Streamflow, *Flow measurement.

Current meters are frequently used in the gaging of streams and rivers; these instruments emit one or more pulses per revolution of the rotor, pulses which the operator hears in an earphone and must count over a timed period. While counting at low speeds presents no problems, errors can occur when the currents are fast or the operator is tired. The device described in this paper was designed to reduce counting errors and make gaging easier. It provides an accurate count, even at rates greater than 20 counts per second, automatically stopping after a preselected time period. It has proved easy to use and reliable, and is both light and compact enough to be hung around the operator's neck, thus leaving his hands free. (Sims-ISWS)
W80-04537

INSTANTANEOUS RAINFALL RATE: ITS MEASUREMENT AND ITS INFLUENCE ON HIGH-VOLTAGE TRANSMISSION LINES,
American Electric Power, North Liberty, IN.
H. Kirkham.
Journal of Applied Meteorology, Vol 19, No 1, p 35-40, January 1980. 8 Fig, 3 Ref.

Descriptors: *Rainfall, *Rainfall intensity, *Rain gages, *Electric power, Measurement, Equipment, Electrical coronas, Transmission lines, Transmission(Electrical), Precipitation(Atmospheric), Meteorology, Engineering, Electrical engineering.

When a high-voltage transmission line is exposed to rain, there is generally a small amount of corona activity at the surface of the conductors. This activity usually results in a power loss and the generation of audible and radio noise. While the power loss is generally very small compared to the power transmitted, it is possible to measure it on short test lines where no power is carried through the line. It has been found that there are variations in the power loss, and to a lesser extent in the audible and radio noise, during a typical rainstorm. These variations have been ascribed to variations in the instantaneous rainfall rate. An instrument was developed to measure the instantaneous rainfall rate. The results confirm, in fact, that most of the variations in the corona parameters can be attributed to variations in the instantaneous rainfall rate, although the relationships are not simply linear. The instrument was described in this paper, and some of the results showing the correlation between rainfall rate and the corona loss and audible noise from an ultra-high voltage test line in northern Indiana were presented. (Sims-ISWS)
W80-04538

SIMPLE FIELD METHODS FOR ESTIMATING SOIL HYDRAULIC CONDUCTIVITY,
Sao Paulo Univ. (Brazil). Center for Nuclear Energy in Agriculture.
P. L. Libardi, K. Reichardt, D. R. Nielsen, and J. W. Biggar.
Soil Science Society of America Journal, Vol 44, No 1, p 3-7, January-February 1980. 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Hydraulic conductivity, *Soil physical properties, *Methodology, *Moisture content, On-site tests, Soil water movement, Infiltration, Steady flow, Spatial distribution, Soil water redistribution.

Soil water content profiles monitored as a function of time following steady-state infiltration conditions in a field soil provide the only data necessary to estimate the soil hydraulic conductivity as a function of soil water content. For two proposed methods, it is assumed that water redistributes only in response to the gravitational field and that the hydraulic conductivity is an exponential function of soil water content. Experiments were conducted on three fallow field soils covered with plastic to prevent evaporation and sampled to depths of nearly 2 m. Values of hydraulic conductivity calculated by both the two proposed methods as well as by a third recently reported method were compared with those calculated by integrating Richards' equation without simplifying assumptions. Although the above comparisons at given sites within a field revealed that the three methods may sometimes yield poor estimates of the hydraulic conductivity, distributions of observed values averaged over the entire field were statistically comparable for 20 observations. It was concluded that a greater number of observations made possible by simplifying assumptions, and hence, less instrumentation and cost, is preferable to fewer observations with more exact methods that are not as amenable to statistical analyses over larger land areas. (Visocky-ISWS)
W80-04540

AN AUTOMATIC ELECTRICAL RESISTANCE SOIL-MOISTURE MEASURING SYSTEM,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 2G.
W80-04622

A STUDY OF STRONTIUM-90 MOVEMENT IN A SANDY SOIL,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de Radio-Agronomie.
P. Couchat, F. Brissaud, and J. P. Gayraud.
Soil Science Society of America Journal, Vol 44, No 1, p 7-13, January-February 1980. 6 Fig, 3 Tab, 18 Ref.

Descriptors: *Strontium, *Dispersion, *Soils, *Adsorption, *Leaching, Solutes, Tracers, Radioisotopes, Sands, Pore water, Velocity, Hysteresis, Calcium, Desorption, Shaking, Soil columns, CSMP(Continuous System Modeling Program).

Different methods were used to describe 90Sr movement in a Montpellier sandy soil at a pore water velocity of about 0.1 cm/sec. Shaking tests showed that the adsorption and the desorption of 90Sr on this soil material may be considered as instantaneous and that the equilibrium adsorption-desorption relation was hysteretic. However, adsorption-desorption data obtained from material balance calculations on effluent data from soil columns did not agree with those obtained from shaking tests. This difference was confirmed by comparison of measured breakthrough curves for 90Sr and tritiated water with those calculated using equilibrium isotherms obtained from shaking tests. Equilibrium adsorption-desorption isotherms obtained from fitting of experimental breakthrough curves by a S/360 CSMP simulation model agreed well with the experimental data derived from the material balance method. The results show that isotherms from shaking tests overestimate the effect of 90Sr adsorption-desorption during transport. The hysteresis effect was less pronounced in the data obtained by the material balance method, and it was shown that an approximating, linear, nonhysteretic adsorption-desorption isotherm adequately described for practical purposes the leaching of 90Sr in the sandy soil. (Visocky-ISWS)
W80-04637

DESK TOP METHODOLOGY FOR MODELING BIOCHEMICAL OXYGEN DEMAND IN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-176142, Price codes: A02 in paper copy, A01 in microfiche. Partial completion report, April 1980. 16 p. OWRT A-046-NJ(4), 14-34-0001-9032.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Mathematical models, Organic matter, Oxygen sag, Water pollution, Water quality, Streams.

The modeling of dissolved oxygen as widely practiced involves considerable uncertainties due partly to the assumptions not fully represented by the model and also, usually great deficiencies in data. The diurnal fluctuation of oxygen complicates the water. Methods are presented and illustrated for modeling the BOD process instead, and later calculating the critical oxygen condition at the sag point only. The necessary computations can be made by hand calculator, and used quickly to check validity of data.
W80-04673

EXOTIC TECHNIQUES HELP DRILLERS.
Drilling Contractor, Vol 36, No 3, p 21-22, March, 1980. 3 Fig.

Descriptors: *Drilling equipment, *Drilling fluids, *Telemetry, Logging instrumentation, Electronic equipment, Boreholes, Rotary drilling, Downhole motors.

New developments in drilling technology are described. A wire telemetry system stores logging cable in a long loop inside drill pipe. The loop rotates with the drill pipe and the cable is withdrawn as the drill string lengthens. The electronic package can reliably withstand the rigors of bottom-hole drilling conditions. For certain formations the use of air, mist, or foam as drilling fluids can result in considerable economic advantage over liquid mud systems in terms of penetration rate and bit life. A dual string-airlift reverse circulation method was used to drill 120-inch holes at the Nevada Test Site. The mechanics of this method are based on the principles of air-lift pumping. Air and fluid are introduced in the annulus between the drill pipe and inner string. Drilling fluids exit through the bit jets to clean the bottom of the hole and air exits through the air jets to provide the required air lift for the fluid and cuttings. An advanced well drilling method, called Electrodrill, includes a downhole electric drill motor and electronic sensor plus telemetric package linked to the surface with a cable/connector conductor system, power generation and regulation equipment. (Purdin-NWWA)
W80-04774

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1978.
Geological Survey, Albuquerque, NM. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-160864, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NM-78-1, September 1979. 677 p, 6 Fig, 3 Tab.

Descriptors: *New Mexico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 229 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 89 gaging stations, 15 partial-record stations, 2 reservoirs, 3 springs and 99 wells; and water levels for 96 observation wells. Also included are 144 crest-stage partial-record stations and 2 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Mexico. (Kosco-USGS)
W80-04547

WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1978.
Geological Survey, Little Rock, AR. Water Resources Div.
Geological Survey Water-Data Report AR-78-1, September 1979. 668 p, 5 Fig, 3 Tab.

Descriptors: *Arkansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Arkansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 75 gaging stations; stage only records for 1 gaging station; stage and contents for 10 lakes and reservoirs; water quality for 156 stations, 85 partial-record flow stations, and seven lakes; and water levels for 91 observation wells. Also included are 122 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (Kosco-USGS)
W80-04548

WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1978.
Geological Survey, Jackson, MS. Water Resources Div.
Geological Survey Water-Data Report MS-78-1, February 1980. 507 p, 5 Fig.

Descriptors: *Mississippi, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Mississippi consist of records of stage and discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. This report contains discharge records for 82 gaging stations, stage records for 15 of these gaging stations. Stage only for 3 gaging stations, contents for 4 lakes, water quality for 25 gaging stations, and 164 wells, and water levels for 175 observation wells. Also included are data for 92 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. (Kosco-USGS)
W80-04549

WATER-QUALITY DATA FOR THE HANNA AND CARBON BASINS, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
P. B. Freudenthal.
Available from: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, paper copy $6.00, micro-

fiche $3.50. Geological Survey open-file report 79-1277, August 1979. 41 p, 4 Fig, 7 Tab, 10 Ref.

Descriptors: *Water quality, *Hydrologic data, *Wyoming, *Groundwater, *Surface waters, Data collections, Sites, Gaging stations, Water wells, Sampling, Sediment load, Chemical analysis, Water analysis, Trace elements, Radiochemical analysis, *Hanna Basin(Wyo), *Carbon Basin(Wyo).

Water-quality data for the Hanna and Carbon Basins, south-central Wyoming, are presented in tables with no interpretation. Common-constituent, trace-element, and radiochemical data for ground and surface water and sediment concentrations for surface water are included. Ground water at 53 sites and surface water at 3 gaging stations were sampled. (Kosco-USGS)
W80-04560

GROUND-WATER BASIC DATA FOR RANSOM AND SARGENT COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
North Dakota County Ground-Water Studies 31--Part II, and North Dakota Geological Survey Bulletin 69-Part II, 1979. 637 p, 2 Fig, 1 Plate, 5 Tab, 21 Ref.

Descriptors: *Groundwater, *Basic data collections, *North Dakota, *Groundwater availability, *Water quality, Aquifers, Water wells, Logging(Recording), Observation wells, Well data, Chemical analysis, Groundwater movement, Mineralogy, Water properties, Potential water supply, Water utilization, Ransom County(N Dak), Sargent County(N Dak).

This report contains hydrologic data for wells and test holes in Ransom and Sargent Counties, N. Dak. Included are logs of test holes and wells, chemical analyses of water samples, chemical analyses of minor elements in ground water, and water-level measurements in observation wells. The data are useful for evaluating ground-water and geologic conditions in Ransom and Sargent Counties. (Kosco-USGS)
W80-04564

HYDROGEOLOGY OF THE PEERLESS LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
W. Ceroici.
Earth Sciences Report 79-5, 1979. 10 p, 2 Fig, 1 Tab, 13 Ref, 1 Append, 1 Map.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, *Canada, *Data collections, Aquifer characteristics, Geology, Groundwater movement, Water quality, Calcium, Magnesium, Lakes, Stratigraphy, Hydrologic aspects, Artesian aquifers, Water yield, Alluvial aquifers, Vegetation, Topography, Climatology, *Alberta, *Peerless Lake(Alberta).

The Peerless Lake map area (NTS 84B), situated in north-central Alberta, is bounded by longitudes 114 deg and 116 deg west and latitudes 56 deg and 57 deg north. Total area is approximately 13,000 sq km. The area is sparsely populated and access is poor. The area is covered by thick surficial deposits, primarily of glacial origin, overlying Cretaceous shales. Yields of up to 38 L/s (500 igpm) may be obtained from glaciofluvial deposits. The greatest yields are available from preglacial sands and gravels located in portions of the Misaw and Atikameg Buried Valleys. In general, the bedrock is a poor aquifer yielding usually less than 0.4 L/s (5 igpm). Groundwater from surficial deposits is predominantly the calcium/magnesium-bicarbonate type with an average total dissolved solids concentration of 1000 mg/L. Muskeg waters chemically resemble waters from surficial deposits, but total dissolved solids concentration rarely exceeds 250 mg/L. Bedrock groundwaters are the sodium/potassium-chloride type with an average total dissolved solids concentration of over 2000 mg/L. (Humphreys-ISWS)
W80-04646

AIDS FOR DOCUMENTING FIELD DATA,
Hydro-Search, Inc., Denver, CO.
L. C. Atkinson.
Ground Water, Vol 18, No 1, p 70-76, January-February, 1980.

Descriptors: *Drilling logs, *Data collections, *Well data, *Documentation measurement, Monitoring, Sampling, Analysis, Charts, Investigations, Hydrologic data, Water quality, Water levels, Water wells.

Field data forms for aquifer tests, water level measurement, borehole logs, well construction summaries, and water quality sampling and analysis are described. The borehole logs records standard, basic geologic information, as well as parameters specifically relevant to boreholes used for exploration or water supply. The well construction summary provides a concise, comprehensive documentation of the drilling, design, construction, and development of a water well. The aquifer test form records data from both pumping and observation wells during the pumping and/or recovery portions of an aquifer test. The water level data form is used to record water levels in wells as part of monitoring programs, well inventories, etc. It can record time versus water level for a single well or water levels in numerous wells on a single date. The field water quality sampling and analysis form records basic field water chemistry data, and sampling and preparation/preservation techniques. It can be used for sampling and analysis of both ground and surface water and for recording any variations in water quality parameters during an aquifer test. (Purdin-NWWA)
W80-04676

8. ENGINEERING WORKS

8A. Structures

BROAD-CRESTED WEIRS FOR PORTABLE FLOW METERING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and A. J. Clemmens.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 6, p 1324-1328, November-December 1979. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Weirs, *On-site investigations, *Critical flow, *Discharge measurement, *Irrigation canals, Flow measurement, Hydraulics, Open channel flow, Submergence, Design, Hydraulic engineering, *Broad-crested weirs, Portable measuring flumes.

A portable flume was developed to measure flow rates in standard concrete slip-form irrigation canals with a 0.305-m (1 ft) bottom width and 1:1 side slopes. The flume weighs less than 14 kg (30 lb) and would fit in a 0.915-m (3-ft) cube. The flume resembles a broad-crested weir with only two finished surfaces: a long, flat weir crest and a rounded approach ramp. The flume calibration was derived from a mathematical model that has been verified by laboratory testing. The flow depth upstream from the weir is translated to a point above the flume throat, making it relatively insensitive to leveling inaccuracies. This device makes flow measurement both fast (typically 5 to 10 min) and accurate (within + or - 2%). (Adams-ISWS)
W80-04527

WATER RESOURCES DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04594

DESIGN OF GRAVEL PACKS IN DEVIATED WELLBORES,
Exxon Production Research Co., Houston, TX.
C. Gruesbeck, W. M. Salathiel, and E. E. Echols.
Journal of Petroleum Technology, Vol 31, No 1, p 109-115, January 1979. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Boreholes, *Gravels, *Well filters, Well screens, Slurries, Laboratory tests, Model-studies, Lysimeters, Mathematical models, Velocity, Pressure head.

Deviated borehole often have unstable or incomplete placement of gravel around the screen and result in sand production. The process by which gravel is transported in deviated wells is described on the basis of observations made while gravel packing small-scale laboratory models. A new design technique is derived that can predict whether a set of design conditions will result in a complete gravel pack that fills the entire borehole-screen annulus. Two experimental relationships which determine the correct design conditions are: (1) the equilibrium velocity necessary to prevent particle deposition in the casing screen annulus, and (2) the incremental pressure gradient caused by the solids in the flowing particle slurry. Experimental relationships for the equilibrium velocity and the pressure gradient of particle slurries were combined with steady state mass and momentum balances to develop a mathematical model of the gravel placement process. The predictions of the model were verified in full-scale gravel-packing studies. Twenty deviated boreholes with angles of deviation from 45 to 62 degrees and with lengths ranging from 40 to 240 ft have been successfully gravel packed using this technique. (Purdin-NWWA)
W80-04631

WELL GROUTING AND CASING TEMPERATURE INCREASES,
Auburn Univ., AL. Dept. of Civil Engineering.
R. C. Johnson, Jr., C. E. Kurt, and G. F. Dunham, Jr.
Ground Water, Vol 18, No 1, p 7-13, January-February, 1980. 13 Fig, 1 Tab, 7 Ref.

Descriptors: *Cement grouting, *Water wells, *Well casing, *Temperature, Plastic pipe, Heat resistance, Portland cements, Laboratory tests, Hydration, Heat, Curing, Deformation, Collapse.

When Portland cement-based grouts cure, a by product of the process is the heat of hydration which may result in deformation and premature collapse of thermoplastic well casing. Since each type of thermoplastic casing has specified temperature limits, it is important to know the range of temperature increases that might occur during grouting. A series of laboratory experiments was performed to determine these temperature increases. The Type I Portland cement used in the experiments was found to produce a higher peak temperature than a similar mix containing 2 percent calcium chloride. For nominal 1 1/2-inch grout thickness, temperature increases between 17 F and 25 F were achieved. With a 3 5/8-inch grout thickness, peak temperature increased to 67F. Where thick grout envelopes occur as a result of caving within the borehole, temperature increases on the order of 170-190F can be expected. Casing temperature usually reaches a peak 8-10 hours after water was added to the cement and remained near the peak temperature for several hours before returning to the original temperature. The ratios of the grout-soil interface surface area and the grout-casing interface area to the grout volume significantly influences the peak casing temperatures. Small-diameter casings have higher peak temperatures than large diameter casing. (Purdin-NWWA)
W80-04650

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
For primary bibliographic entry see Field 8C.
W80-04764

DESIGN OF WASTEWATER TREATMENT FACILITIES, MAJOR SYSTEMS.
Office of the Chief of Engineers (Army), Washington, DC.
Engineering Manual EM-1110-2-501, Part 1 of 3, September 1978. 747 p, 44 Fig, 44 Tab, 255 Ref, 1

Group 8A—Structures

Append. EM 1110-2-501.

Descriptors: *Wastewater treatment, *Physical processes, *Biological processes, *Chemical processes, *Design criteria, *Wastewater treatment facilities, Treatment, Wastewater disposal, Waste disposal, Waste treatment, Tertiary treatment, Sewage treatment, Biological treatment, Design, Urbanization.

This manual provides guidance for the selection of wastewater treatment systems and processes and criteria for the design of wastewater treatment facilities in urban areas. Part One serves to familiarize the designer with the practical and theoretical aspects of physical, chemical, and biological processes and process trains for urban-type facilities ranging from simple to complex systems, including tertiary systems for nutrient removal. The physical unit processes discussed include grit removal, screening, commination, equalization, flotation, thickening (gravity), sedimentation (primary and secondary clarifier), filtration, vacuum filtration, centrifugation, microscreening, drying beds, postaeration, sludge hauling and landfilling, multiple-hearth incineration and fluidized bed incineration. The chemical unit processes discussed are carbon absorption, chemical coagulation, ammonia stripping, chlorination, ion exchange, neutralization, recarbination and two-stage lime treatment. The biological unit processes described are trickling filters, plug flow activated sludge, complex mix activated sludge, step aeration activated sludge, extended aeration activated sludge, modified or high-rate aeration activated sludge, contact stabilization activated sludge, pure oxygen activated sludge, aerated aerobic lagoons, aerated facultative lagoons, oxidation ditch, nutrification-denitrification, aerobic digestion, anerobic digestion and stabilization ponds. Factors determining process selection include stream standards and/or receiving water quality, federal state and local effluent criteria, wastewater characteristics, economics, availability of fuel and/or electric power, specific exclusions of certain processes and possible requirements for future expansion and/or upgrading. (Iervolino-NC)
W80-04773

EXOTIC TECHNIQUES HELP DRILLERS.
For primary bibliographic entry see Field 7B.
W80-04774

8B. Hydraulics

PROBABLE HYDROLOGIC EFFECTS OF A HYPOTHETICAL FAILURE OF MACKAY DAM ON THE BIG LOST RIVER VALLEY FROM MACKAY, IDAHO, TO THE IDAHO NATIONAL ENGINEERING LABORATORY,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-04551

8C. Hydraulic Machinery

HYBRID ENERGY SYSTEM: WIND AND WATER,
Nevada Univ. System, Reno. Desert Research Inst.
J. W. Fordham, M. K. Peck, R. McMullen, and A. B. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-171218, Price codes: A05 in paper copy, A01 in microfiche. Publication No 41062, February 1980. 74 p, 18 Fig, 7 Tab, 10 Ref, 1 Append. OWRT B-086-NEV(1), 14-31-0001-6098.

Descriptors: *Hydroelectric power, *Winds, *Energy conversion, *Reservoir storage, Powerplants, Electric power costs, Power operation and maintenance, Electric power rates, Nevada, Transmission lines, Wind velocity, Air circulation, Design criteria.

The potential for using wind together with hydro generation to meet small area energy demands was examined and a prototype wind-hydro system was modeled for a Nevada site to determine optimum component sizes and operation. The wind-hydro system is designed as an alternative to conventional power generation methods especially in remote areas where the construction of transmission lines is not economically practical. The system includes a reservoir to catch as much runoff as possible, a hydroelectric generation plant, a wind turbine, and a generator. To offset the variability of energy supply from the wind, wind energy conversion systems (WECS) drive recharge pumps to the upstream reservoir where water is stored to be released to drive the hydroelectric generators when needed for a steady energy supply. Costs and benefits are examined in a generalized manner for six preliminary designs then in detail for a wind-hydro system located on Slide Mountain in Nevada. Major points of wind-hydro consideration resulting from the site specific study include: the availability and reliability of wind data, ice accumulation on the WECS structure, WECS cost reduction, pump cost estimates, penstock and recharge pipe assumptions, reservoir costs, reservoir losses, streamflow characteristics, and the market value of power. The wind-hydro system can be a profitable alternative that employs a free, inexhaustible, nonpolluting form of energy. (Seigler-IPA)
W80-04502

EVALUATION AND DESIGN OF DOWNHOLE HEAT EXCHANGERS FOR DIRECT APPLICATION,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
G. Culver, and G. M. Reistad.
Geo-Heat Utilization Center Quarterly Bulletin; Vol 1, No 3, August, 1975. 12 p, 16 Fig, 2 Tab, 2 Ref.

Descriptors: *Geothermal studies, *Heat exchangers, *Shallow wells, *Mathematical models, Design, Economics, Energy equation, Convection, Mixing, Discharge(Water), Flow measurement.

The results of a study of the design and economics of downhole heat exchanger (DHE) systems are presented. Energy balance calculations and measurements of convection cell circulation in hot wells were used to develop analytical models to predict heat extraction rates with and without a DHE. In general, increases in source temperature, well diameter, and mass flow rate provide increased energy extraction rates. Mixing of new and circulating well water can be calculated but not accurately predicted before testing a well. Multitube heat exchangers were designed and tested with outputs within 15% of the values predicted by the analytical models. Economic analyses indicate that for small to moderate withdrawal rates from shallow wells and about 300 KW thermal, DHE's may be more economical than pumped systems when surface discharge is not acceptable. (Purdin-NWWA)
W80-04764

STUDIES AIM AT OPTIMUM DESIGN FOR PDC HARD-FORMATION BITS,
Sandia Lab., Albuquerque, NM.
S. G. Varnado, C. F. Hunt, and P. Yarrington.
World Oil, Vol 190, No 4, p 63-66, 70, March, 1980. 8 Fig, 33 Ref.

Descriptors: *Drill bits, *Geothermal studies, *Laboratory tests, *On-site tests, Computer models, Stress analysis, Design, Bonding, Penetration, Crystalline rock.

Geothermal drill bits using polycrystalline diamond compact (PDC) cutters have the potential for increasing penetration rate and reducing the cost of drilling. The results of single cutter tests, bit design, bonding of cutters to the bit body, and lab and field tests on new bit designs are described. A computer program was developed to model the stresses induced into the tool by the tool-rock interaction and to design the optimum cutting structures. Main problem areas identified during testing are: attachment of cutters to the tool post or to the bit body directly; and potential for tool post breakage in field drilling operations. (Purdin-NWWA)
W80-04767

8G. Materials

DIAMOND COMPACT CUTTER STUDIES FOR GEOTHERMAL BIT DESIGN,
General Electric Corporate Research and Development, Schenectady, NY. Physical Chemistry Lab.
L. E. Hibbs, Jr., and D. G. Flom.
Journal of Pressure Vessel Technology, Vol 100, No 11, p 406-416, November, 1978. 17 Fig, 4 Tab, 7 Ref.

Descriptors: *Drilling equipment, *Geothermal studies, *Laboratory tests, Penetration, Rock excavation, Research and development, Design data, Abrasion, Rotary drilling.

Rock cutting studies using diamond compact cutters were undertaken to determine the following relationships needed in designing a more efficient geothermal bit: (1) the effect of cutter size on rate of material removal and on torque, (2) the effect of the degree of cutter overlap on cutting efficiency; (3) penetration rate as a function of rotational speed and cutter size; (4) the effect of rotational speed on force and cutter wear rate; (5) the effect of cutter geometry on penetration rate, force, and cutter wear rate; and (6) variations of these parameters as required by the range of rock properties encountered in geothermal formations. Rake angles affected cutting efficiency at light cuts but were less significant at high penetration forces. In continuous turning, cutter forces exhibit regular, repeated variations due to the rock undergoing alternate crushing and fracturing. In interrupted cutting, the variations in forces are no greater than in continuous cutting. Thus, force fluctuations when cutting a composite of hard and soft rock should not be significantly greater than those generated in cutting each rock separately. The effects of changing speed were not as great as those of geometry and depth of cut. (Purdin-NWWA)
W80-04531

THE EVALUATION OF A SYNTHETIC MATERIAL FOR USE AS A WAVE PROTECTION AGENT ON IRRIGATION DAMS,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
R. W. Stephenson, L. D. McCallister, and D. L. Dutton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-173586, Price codes: A08 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, March 1980. p 162, 79 Fig, 11 Tab, 117 Ref, 4 Append. OWRT B-122-MO(2), USDI-OWRT-14-34-0001-8095.

Descriptors: *Earth dams, Erosion, Dams, Filter fabrics, Models, Reservoirs, Shore protection, Waves(Water), Protection, *Irrigation dams, *Slope protection, Model studies, *Bank protection, *Sand pillows.

This report presents the results of a field and laboratory testing program to evaluate the performance of a slope protection method utilizing a new synthetic fabric material in the form of soil filled bags. The results of this investigation indicate that the system is readily installed on irrigation dams and offers excellent slope protection. The factors which influence the practicality of the system include the cost of alternate slope protection methods, the position of the irrigation dam in relation to local winds and the availability of fill material for the bags. A medium-scale laboratory model study was performed on a new synthetic fabric designed to be used in the form of soil-filled 'sand pillows' in order to determine the relationship that affect the stability of the pillows and to determine basic design criteria for the protection system. Laboratory tests were conducted to determine the soil retention characteristics of the fabric. The results of the model study investigation indicate that the stability of sand pillows is primarily a function of wave height, wave period, embankment slope angle, and individual sand pillow

weight. A possible design equation was developed for a silty clay soil such that the wave height calculated for a given reservoir could be utilized to determine the weight of the individual sand pillow necessary to economically and effectively protect the embankment.
W80-04599

WELL GROUTING AND CASING TEMPERATURE INCREASES,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W80-04650

GROUNDWATER CHARACTERISTICS AND CORROSION PROBLEMS ASSOCIATED WITH THE USE OF GEOTHERMAL WATER IN KLAMATH FALLS, OREGON,
Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
J. W. Lund, G. Culver, and P. J. Lienau.
Geo-Heat Utilization Center Quarterly Bulletin, Vol 3, No 2, May, 1977. 17 p, 4 Fig, 6 Tab, 10 Ref.

Descriptors: *Geothermal studies, *Corrosion, *Water chemistry, *Materials testing, Scaling, Temperature, Corrosion control, Well casings, Heat exchangers, Regression analysis, Geochemistry, Ions, Steel pipes.

This report presents the results of two investigations of corrosion of downhole heat exchangers. In one study, temperature and chemistry data for over 100 wells were collected and correlated with heat exchanger service life. Contrary to results of other corrosion studies, high temperature was related to longer service life. However, this may be due to some other factor related to high temperature. Corrosion and scaling of well casing is not as severe as that of heat exchangers since fluid production through the casing is not required. Corrosion occurs at the air/water interface and can be effectively reduced by pouring oil or wax in the well. In the second study, corrosion rates for various materials were determined from coupon tests in well water with temperatures ranging from 32 to 49C, pH between 7.1 and 8.2, and total dissolved solids content of about 800 ppm. Mild steel had low resistance to corrosion. Ions having the highest correlation with corrosion rate were sodium, water hardness, chloride, sulfate, and pH. (Purdin-NWWA)
W80-04763

STUDIES AIM AT OPTIMUM DESIGN FOR PDC HARD-FORMATION BITS,
Sandia Lab., Albuquerque, NM.
For primary bibliographic entry see Field 8C.
W80-04767

8H. Rapid Excavation

DIAMOND COMPACT CUTTER STUDIES FOR GEOTHERMAL BIT DESIGN,
General Electric Corporate Research and Development, Schenectady, NY. Physical Chemistry Lab.
For primary bibliographic entry see Field 8G.
W80-04531

EXOTIC TECHNIQUES HELP DRILLERS.
For primary bibliographic entry see Field 7B.
W80-04774

8I. Fisheries Engineering

IMPROVING STREAM FISHERIES,
Oklahoma State Univ., Stillwater.
O. E. Maughan, and K. L. Nelson.
Water Spectrum, Vol 12, No 2, p 11-15, Spring 1980. 5 Fig, 5 Ref.

Descriptors: *Virginia, *Stream improvement, *Fish management, *Stream fisheries, *Hydraulic structures, Gabions, Dams, Boulders, Trout, Aquatic environment, Biomass, Productivity, Streamflow, Diversion, Runoff, Scour.

Stream physical characteristics, aquatic macroinvertebrates, and fish population in four Virginia streams, North Creek, Jennings Creek, Comers Creek, and Crooked Creek were evaluated to compare improved and unimproved river sections. Various techniques used to improve fishery conditions by increasing pool area and cover amounts in the stream include log dams, boulder enplacements, and gabion deflectors. All of the streams are typical trout waters with rapid flow along mountain slopes. Due to the mountain setting rapid runoff and periodic flooding are common. All of the streams flow through forested land except Crooked Creek which is affected by livestock grazing and adverse agricultural practices. Log dams in North Creek did increase pool area by about 7% but due to improper placement of some of the dams and lack of increased cover the results are not conclusive. Some increases in total biomass were recorded for the improved sections of the stream. The gabions on Jennings Creek did appear to promote pool formation but lack of pregabion data makes accurate assessment difficult. Five of the twelve boulder placements in Crooked Creek did result in undercutting and pool formation. Some negative results of the improvement methods include deposition of sand behind boulders and bank erosion during high flow. Gabions and log dams were susceptible to high flow destruction and did not provide cover. Boulders provide cover but stream depth is a major factor and boulders may be impractical if not readily available. (Seigler-IPA)
W80-04506

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER RESEARCH AND DEVELOPMENT ACT OF 1978 - LEGISLATIVE HISTORY.
For primary bibliographic entry see Field 6E.
W80-04592

WATER RESEARCH AND DEVELOPMENT ACT OF 1978.
For primary bibliographic entry see Field 6E.
W80-04593

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

HYDROLOGY RESEARCH DIVISION--ANNUAL PROGRESS REPORTS AND SHORT RESEARCH NOTES 1977-78.
Department of Fisheries and Environment, Ottawa (Ontario). Water Resources Branch.
Report Series No 64, 1979. 117 p, 33 Fig, 10 Tab.

Descriptors: *Water quality, *Water quality parameters, *Hydrogeology, *Canada, *Groundwater pollution, Hydrothermal studies, Models, Computer programs, Data retrieval, Well injection, Water pollution, Groundwater, Acquifers, Irrigation, Design flow, Reservoirs, Runoff forecasting.

Results of 29 studies of water quality and water quantity are presented. Included are hydrogeological studies of the effects of open-pit mining and dewatering, a salmon enhancement program, a wildlife preserve, inland wetlands sites, and the hydrogeology of the Fraser Valley. Hydrologic modelling studies presented include: streamflow simulation, evaporation and runoff, mathematical modelling of a wellfield, snowmelt infiltration and runoff, and irrigation return flow amounts and rates. The Bowen-ratio evapotranspiration estimates project is described; an experimental system was set up at Perch Lake during 1977. Inconclusive results were obtained due to system electrical interference. Groundwater studies summarized covered arsenic contamination sites and amounts, and existing groundwater trace element parameters such as pH, Eh, dissolved oxygen, temperature, and major anions and cations in order to assess their influence on trace element migration. Results of use of the GOWN computer program and its ability to document and retrieve data are summarized. A project studying hydrothermal effects in areas adjacent to Artic streams is described, and results of field dispersion tests at the Chalk River Nuclear Laboratories are presented. (Arnold-NC)
W80-04753

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 15
AUGUST 1, 1980

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CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 15
AUGUST 1, 1980

W80-04801 -- W80-05100

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

LINEARIZED SUBHYDROGRAPH ROUTING OF DIRECT RUNOFF,
Nevada Univ. System, Reno. Desert Research Inst.
V. L. Gupta, P. C. Orphan, and J. W. Bird.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182058, Price codes: A03 in paper copy, A01 in microfiche. Publication No 41060, September 1979. 27 p, 4 Fig, 3 Tab, 16 Ref. OWRT-A-090-NEV(1), 14-34-001-9030.

Descriptors: *Peak discharge, *Forecasting, *Hydrograph analysis, Methodology, Reviews, Evaluating, Computer programs, Ungaged drainage basins, Rainfall-runoff relationships, Streamflow, Flow rates, Runoff, *Linearized Subhydrograph Routing.

A pilot study was conducted involving the development and testing of a computerized methodology entitled 'Linearized Subhydrograph Routing' for the estimation and simulation of the peak rates of runoff from small drainage basins. The method can be considered a refinement over the more popularly used 'rational method.' Selected rainfall-runoff events of twelve drainage basins were utilized in testing the methodology. Several limitations were recognized. The Linearized Subhydrograph Method uses data readily available to engineers, was written as a computer program for ease of calculation, and was tested with field data. (Smith-Nev)
W80-04813

WATER STORAGE ON FOREST FOLIAGE: A GENERAL MODEL,
Oregon Univ., Eugene. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-04826

ON A MODEL OF A NONLINEAR FEEDBACK SYSTEM FOR RIVER FLOW PREDICTION,
University of Manchester Inst. of Science and Technology (England).
For primary bibliographic entry see Field 2E.
W80-04828

WISCONSIN, A SUMMARY OF ACTIVITIES AND PLANS OF THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 1979.
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04859

USE OF THE CLIMATIC WATER BUDGET TO ESTIMATE STREAMFLOW,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180896, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware. Technical Research Report, July 1979. 52 p, 3 Fig, 12 Tab, 14 Ref, 5 Append. OWRT A-040-DEL(4), 14-34-0001-9008.

Descriptors: *Streamflow forecasting, *Climatology, *Water balance, *Hydrologic budget, Precipitation(Atmospheric), Runoff, Overland flow, Soil water movement.

The climatic water budget provides values of water surplus, the precipitation in excess of both the evapotranspiration needs and the needs for recharge of storage in the soil root zone. It is this surplus water which will ultimately find its way to the surface to the surface streams. This report describes the problems involved in obtaining good agreement between monthly computed and measured runoff, the problems of snow accumulation and snowmelt runoff and illustrates in a step-by-step example how to lag the monthly surplus values to simulate the slow movement of water through the soil to the water table and then to the surface stream. The report also includes all necessary tables and instructions to permit computation of direct overland runoff by means of the Soil Conservation Service method and shows how such an approach can be incorporated into the climatic water budget bookkeeping procedure.
W80-04874

2B. Precipitation

INTERVENTION ANALYSIS WITH MISSING DATA,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-04823

MULTIVARIATE SHORT-TERM RAINFALL PREDICTION,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
E. R. Johnson, and R. L. Bras.
Water Resources Research, Vol 16, No 1, p 173-185, February 1980. 13 Fig, 12 Ref. NSF ENG76-118-17.

Descriptors: *Rainfall, *Forecasting, *Model studies, Mathematical models, Storms, Storm runoff, Runoff forecasting, Weather forecasting, Rain gages, Precipitation(Atmospheric), Sewers, Urban runoff, Meteorology, Short-term forecasting.

Accurate hydrologic forecasting for basins with a short response time depends on the ability to predict quantitative rainfall rates. This study developed a stochastic model for short-term (of the order of 1 hour or less) rainfall prediction. The model simultaneously predicts rainfall rates at multiple locations and for multiple values of prediction lead. All model parameters are estimated solely from telemetered rain gage data for the event being predicted. The model includes velocity and direction of storm movement as explicit parameters. The storm arrival time at each predicted point is likewise an explicit parameter, which is estimated for each location. The mean rainfall rate is not modeled as being either homogeneous spatially or stationary (constant with time). Likewise, the variance of rainfall is nonhomogeneous and nonstationary. (Sims-ISWS)
W80-04824

THE USE OF THE CLIMATIC WATER BUDGET TO EVALUATE THE VALIDITY OF A PRECIPITATION RECORD,
Delaware Univ., Newark. Dept. of Geography.
For primary bibliographic entry see Field 7B.
W80-04877

2C. Snow, Ice, and Frost

COLUMBIA GLACIER STAKE LOCATION, MASS BALANCE, GLACIER SURFACE ALTITUDE, AND ICE RADAR DATA, 1978 MEASUREMENT YEAR,
Geological Survey, Fairbanks, AK. Water Resources Div.
L. R. Mayo, D. C. Trabant, R. March, and W. Haeberli.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $10.00, Microfiche $3.50. Geological Survey, open-file report 79-1168, 1979. 72 p, 4 Fig, 11 Tab, 2 Ref.

Descriptors: *Glaciers, *Measurement, *Forecasting, *Icebergs, Basic data collections, Sites movement, Altitude, Regimen, Ice, Snowpacks, Ablation, Alaska, *Columbia Glacier(Alaska), Prince William Sound, Ice kinematics.

A 1 year data-collection program on Columbia Glacier, Alaska has produced a data set consisting of near-surface ice kinematics, mass balance, and altitude change at 57 points and 34 ice radar soundings. These data presented in two tables, are part of the basic data required for glacier dynamic analysis, computer models, and predictions of the number and size of icebergs which Columbia Glacier will calve into shipping lanes of eastern Prince William Sound. A metric, sea-level coordinate system was developed for use in surveying throughout the basin. Its use is explained and monument coordinates listed. A series of seven integrated programs for calculators were used in both the field and office to reduce the surveying data. These programs are thoroughly documented and explained in the report. (Kosco-USGS)
W80-04855

KNIK GLACIER, ALASKA, MAY 1979 MONUMENT AND GLACIER SURVEY,
Geological Survey, Fairbanks, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04863

2E. Streamflow and Runoff

LINEARIZED SUBHYDROGRAPH ROUTING OF DIRECT RUNOFF,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2A.
W80-04813

EXTENSION AND APPLICATION OF FEATURE PREDICTION MODEL FOR SYNTHESIS OF HYDROLOGIC RECORDS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
U. S. Panu, and T. E. Unny.
Water Resources Research, Vol 16, No 1, p 77-96, February 1980. 11 Fig, 9 Tab, 20 Ref, 2 Append.

Descriptors: *Streamflow, *Synthetic hydrology, *Model studies, *Canada, Rivers, Flow, Mathematical models, Drainage, Watersheds(Basins), Stochastic processes, Analytical techniques, Mathematics, Hydrology.

The method described in this paper for the synthesis of streamflows differed from the traditional approaches in synthetic hydrology in the sense that it utilizes the information contained in or among the groups of data in a streamflow record. The existence of such groups in geophysical records, including hydrologic records, was well emphasized by Hurst. Further, in the proposed method, based on concepts of pattern recognition, neither a basic structure nor any preconceived model was imposed on the data; rather the data are allowed to speak for themselves in a most 'democratic' way. The preliminary details of the method were provided in an earlier paper by Panu and others. The intent of this paper was to describe a procedure whereby it is possible to specify explicitly multivariate probability distribution for the intrapattern structure and first-order Markovian dependence for the interpattern structure in the feature prediction model. The various steps involved in the construction and operation of the model for streamflow synthesis were presented. The application of the model for synthesizing monthly streamflow records of three Canadian rivers exhibiting biannual cycles was explained. Statistical and hydrological tests showed that these synthetic realizations possess relevant properties that are comparable with the corresponding properties contained in the historical record. This article should be read in conjunction with the previous publication by Panu and others. (See also W78-09201) Sims-ISWS)
W80-04816

THE EFFECT OF DAM CLOSURE ON DOWNSTREAM RAPIDS,
Arizona State Univ., Tempe. Dept. of Geography.
W. L. Graf.
Water Resources Research, Vol 16, No 1, p 129-136, February 1980. 9 Fig, 35 Ref.

Descriptors: *Dams, *Streamflow, *Geomorphology, *Boulders, Rivers, Regulated flow, River regulation, Loads(Forces), Floods, Flood peak,

Erosion, Sediments, Sediment transport, Model studies, Mathematical models, On-site investigations, Hydrology, *Rapids, River rapids, Dam effects.

The force of flowing water and the resistance of the largest boulder provide a means of evaluation of the stability of rapids in canyon rivers. Field measurements and calculations showed that the closure of Flaming Gorge Dam, Utah, has had a significant effect on the stability of rapids in the canyons of the Green River in Dinosaur National Monument 68 km (42 mi) downstream from the dam. The reduction in peak flows by the dam has limited the competence of the river to move boulders deposited in the main channel by tributary processes, landslides, and prehistoric floods. Before the dam was closed, 62% of the rapids were stable, as indicated by the immobility of the largest boulder in each rapid. After the dam was closed, 93% of the rapids were stable as geomorphic/hydraulic features, though small boulders continue to move. A continuing buildup of boulders in the rapids will result from tributary contributions which are not affected by the dam. (Sims-ISWS)
W80-04820

INTERVENTION ANALYSIS WITH MISSING DATA,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-04823

ON A MODEL OF A NONLINEAR FEEDBACK SYSTEM FOR RIVER FLOW PREDICTION,
University of Manchester Inst. of Science and Technology (England).
T. Ozaki.
Water Resources Research, Vol 16, No 1, p 225-231, February 1980. 13 Fig, 1 Tab, 15 Ref.

Descriptors: *River flow, *Forecasting, *Model studies, Mathematical models, Rainfall, Runoff, Streamflow, Discharge(Water), Rivers, Time series analysis, Rainfall-runoff relationships, Hydrology.

A nonlinear system with feedback was proposed as a dynamic model for the hydrological system, whose input is the rainfall and whose output is the discharge of river flow. Parameters and orders of the model were estimated using Akaike's information criterion. Its application to the prediction of daily discharges of Kanna River and Bird Creek was discussed. (Sims-ISWS)
W80-04828

DEVELOPMENT OF A SELF-SEALING SAMPLER FOR EPHEMERAL WADI FLOODS,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
For primary bibliographic entry see Field 7B.
W80-04830

NEW ROUTING MODEL FOR CONTINUOUS RUNOFF SIMULATION,
New South Wales Univ., Kensington (Australia).
M. S. K. Chowdhury, and F. C. Bell.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15357, p 489-500, April 1980. 6 Fig, 12 Ref, 2 Append.

Descriptors: *Channel flow, *Flood routing, *Runoff forecasting, Flood flow, Flood forecasting, Overland flow, Storage, Waves(Water), Runoff, Mathematical models, Flow, Model studies, *Runoff simulation, Continuous runoff models, Kinematics.

A new runoff routing model has been developed that combines realistic allowances for the spatial distribution of storage with the theoretically satisfying features of the kinematic wave approximation. Appropriate boundary conditions enable replacement of the partial differential equations describing the flow by tractable total differential equations. Also, similar forms of equations have been adopted to describe both overland and channel flow. All these features result in a relatively simple model with a small number of physically relevant parameters that are not difficult to evaluate. The use of the current discharge as a state variable enables the model to be automatically tuned to the current conditions and is particularly suitable for short-term flood forecasting. (Lee-ISWS)
W80-04831

FINITE ELEMENT METHOD FOR DIRECT RUNOFF FLOW,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
M. Kawahara, and T. Yokoyama.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15341, p 519-534, April 1980. 14 Fig, 15 Ref, 2 Append.

Descriptors: *Storm runoff, *Runoff forecasting, *Finite element analysis, Theoretical analysis, Floods, Flow resistance, Hydrology, Numerical analysis, Rainfall, Runoff, Hydrodynamics, Flow, Viscosity, Friction.

The Galerkin finite element method based on the linear interpolation function and explicit numerical integration scheme in time was used. Three numerical examples were illustrated. The first example was the validation of the present method. The numerical results have compared with the experimental data and the analytical solution. Both results are well in agreement. The second example discussed the selection of the refinement of the finite element mesh and the time increment. Useful suggestions were presented for the selection of the time increment. The third example showed the computation of the direct-runoff flow over Ina basin of Tenryu River. The bed resistance was seen to have significant effects both on the flow pattern and on the computational stability. The finite element method presented in this paper was shown to be adaptable for the prediction analysis of flow change due to structures. (Lee-ISWS)
W80-04832

EXPERIMENTAL DETERMINATION OF THE VELOCITY GRADIENT IN TWO DIMENSIONAL TURBULENT FLOW,
Vanderbilt Univ., Nashville, TN.
For primary bibliographic entry see Field 8B.
W80-04836

A NON-GAUSSIAN MARKOVIAN MODEL TO SIMULATE HYDROLOGIC PROCESSES,
Technical Univ. of Lisbon (Portugal). Centre for Urban and Regional Systems.
L. Valadares Tavares.
Journal of Hydrology, Vol 46, No 3/4, p 281-287, April 1980. 5 Fig, 3 Ref.

Descriptors: *Runoff, *Model studies, *Synthetic hydrology, Mathematical models, Markov processes, Mathematics, Mathematical studies, Time series analysis, Analytical techniques, Hydrology.

A Markovian process (X sub t; t = 0,1,2...) following a negative exponential distribution and with an exponentially decaying autocorrelation function was proposed and described in this paper. This model can be useful to simulate autocorrelated and skewed hydrologic variables. To show this, a successful application to model direct runoff peaks was presented. Some interesting theoretical properties of this process concerning upcrossing intervals and the distributions of extremes were also analyzed. (Sims-ISWS)
W80-04844

CHEMICAL AND SEDIMENT MASS TRANSFER IN THE GODAVARI RIVER BASIN IN INDIA,
Jawaharlal Nehru Univ. New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W80-04845

PYRANINE USED AS A FLUORESCENT TRACER IN HYDROLOGY: PH EFFECTS IN DETERMINATION OF ITS CONCENTRATION,
CEA Centre d'Etudes Nucleaires de Grenoble (France).
For primary bibliographic entry see Field 7B.
W80-04846

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2A-1. SOUTH FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04847

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1978 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-04851

USE OF THE CLIMATIC WATER BUDGET TO ESTIMATE STREAMFLOW,
Delaware Univ., Newark. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W80-04874

2F. Groundwater

AN ANALYSIS OF HYDRODISPERSIVE TRANSFER IN AQUIFERS,
Bureau de Recherches Geologiques et Minieres, Orleans (France). Service Geologique National.
J-P. Sauty.
Water Resources Research, Vol 16, No 1, p 145-158, February 1980. 19 Fig, 1 Tab, 17 Ref.

Descriptors: *Dispersion, *Aquifers, *Mathematical models, Mass transfer, Porous media, Convection, Uniform flow, Curves, Equations, Tracers, Solutes, Groundwater movement, Radial flow, Transport.

This work was concerned with the nonreactive transport of solute materials in groundwater, or hydrodispersive transfer. Several types of flow fields were considered: linear (or uniform) flow with one- and two-dimensional dispersion and radial flow under diverging and converging conditions. The analysis included the two main possibilities for introduction of solutes into an aquifer: continuous and instantaneous (or slug) injection. Different solutions from the literature plus some original solutions for dispersion in a linear flow field have been unified by transposing the solutions into dimensionless variables of concentration (C sub R), time (t sub R), and the Peclet number (P). This permits an analysis of the errors committed in some commonly used approximations for dispersion as a function of P. In the case of radial flow, a numerical method using finite differences has been developed that can be applied to either diverging or converging flow problems. Results in dimensionless form when compared to the only analytical approximations that could be found (for continuous injection in a diverging flow field) indicate that the approximate solutions are in error when P is less than or equal to 10. The radial flow results are also compared to those for linear flow fields to demonstrate that in most cases either approach can be used as long as P is greater than 3. A series of dimensionless type curves has been developed showing C sub R vs. t sub R for practical ranges of P. A simple method of interpreting tracer tests was proposed using these type curves. One is able to directly determine dispersivity and kinematic porosity using curve matching techniques. Results from some recent field tests in France were analyzed using this approach. There is definite confirmation from these investigations that the apparent (macroscopic) dispersivity can vary depending on the distances used in the field. (Visocky-ISWS)
W80-04822

ORGANIC SOLUTE-MINERAL SURFACE INTERACTIONS: A NEW METHOD FOR THE DETERMINATION OF GROUNDWATER VELOCITIES,
Indiana Univ. at Bloomington.
For primary bibliographic entry see Field 7B.
W80-04827

THE ROTATION OF A VERTICAL INTERFACE IN A POROUS MEDIUM,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
A. Verruijt.
Water Resources Research, Vol 16, No 1, p 239-240, February 1980. 2 Fig, 6 Ref.

Descriptors: *Interfaces, *Density, *Porous media, *Model studies, Injection wells, Mathematical models, Groundwater movement, Soil water, Porosity, Hydraulic conductivity, Aquifers, Flow, Viscosity, Permeability, Groundwater, Density interfaces, Interface rotation.

A solution was given to the problem of the simultaneous flow of two different fluids in a vertical plane, separated from each other by a vertical interface. It was shown that the viscosities of the two fluids influence the motion of the interface only through their average value. A simple formula for the rotation of the interface was derived in terms of the relative density difference. (Sims-ISWS)
W80-04829

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2B. SOUTH FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04849

GENERALIZED THICKNESS OF THE SURFICIAL DEPOSITS ABOVE THE CONFINING BED OVERLYING THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Wolansky, R. K. Spechler, and A. Buono.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $1.75, Microfiche $.50. Geological Survey open-file report 79-1071 (WRI), 1979. 1 Sheet, 19 Ref.

Descriptors: *Geohydrologic units, *Aquicludes, *Aquifers, *Aquifer characteristics, *Florida, Groundwater, Maps, Water yield, Shallow wells, Water table, *Floridan aquifer, Southwest Florida Water Management District.

This map report presents the thickness of the surficial deposits overlying the upper confining bed of the Floridan aquifer in the Southwest Florida Water Management District. The surficial deposits range in thickness from less than 25 feet in the western part of the district to greater than 250 feet in the eastern part. The surficial deposits include sand, clayey sand, shell, and shelly marl that occur in the Holocene sand, Pleistocene marine terrace sand, and unconsolidated parts of the Fort Thompson Formation, Caloosahatchee Marl, Alachua Formation, and Bone Valley Formation. Lithologic logs and information from quarries were used in conjunction with an unpublished map prepared during an earlier investigation to compile this map at 1:250,000 scale. (Kosco-USGS)
W80-04864

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING WELL DENSITY IN THE GROUND-WATER SUBUNITS AND AREAS,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04865

GROUND WATER FLOW COMPUTATIONS BY METHOD OF LINES,
Florida Univ., Gainesville. Hydrology Lab.
For primary bibliographic entry see Field 7C.
W80-04950

MEASUREMENT, PREDICTION, AND HAZARD EVALUATION OF EARTH FISSURES AND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. K. Boling, M. Carpenter, N. Johnson, and S. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-183908, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona Project Completion Report, 1980, 96 p. OWRT A-092-ARIZ(1), 14-34-0001-9003.

Descriptors: *Erosion, *Subsidence, *Fissures(Geologic), *Pumping, *Withdrawal, Groundwater, Ephemeral streams, Sediment transport, Deposition(Sediments), Fissure closures, Arizona, *Earth fissures.

Earth fissuring and subsidence research in south-central Arizona consisted of two areas of study: (1) measurement of horizontal movements of earth fissures and (2) mapping of erosional features and hazard evaluation of earth fissures. Our records will form the data base for predictive models of subsidence and earth fissuring. Detailed bimonthly horizontal strain measurements of fissures were made over a three-year period at locations near Signal Peak, Picacho Mountains, and in Avra Valley. Fissures opened and closed repeatedly. They exhibited relatively smooth movement with occasional sudden jumps. During a major event in a locality, all fissures were affected. Some opened, and some closed. Fissures closed during long dry periods and opened after high rainfall. After periods of high pumping rates followed by high rainfall, fissures opened. Among different fissure movements the greatest total was 20.27 mm, the greatest single movement was 30 mm, and, exclusive of that, the greatest net movement was 10.9 mm. Erosional features of earth fissures were mapped and studied over a period of two years at several sites. Documentation of erosional rates and ephemeral-stream processes required the development of original instrumentation. Determination of the approximate volume of sediment and water absorbed by fissure cavities has indicated that fissure depths may commonly exceed 100 m. The relative magnitude of fissure versus subsidence-induced erosion is discussed as to the potential for ground-water contamination by way of fissures.
W80-05006

2G. Water In Soils

INFILTRATION UNDER RAPIDLY VARYING SURFACE WATER DEPTHS,
Stanford Univ., CA. Dept. of Geology.
J. W. Reeder, D. L. Freyberg, J. B. Franzini, and I. Remson.
Water Resources Research, Vol 16, No 1, p 97-104, February 1980. 8 Fig, 18 Ref. NSF ENG76-01271.

Descriptors: *Infiltration, *Soil water, *Model studies, *Laboratory tests, Mathematical models, Soil moisture, Wetting, Soil water movement, Depth, Hydrographs, Infiltration rates, Surface waters, Hydraulic conductivity, Water depths.

Effects of fluctuations in surface water depth on infiltration rates into initially unsaturated soils were investigated by numerically solving the Richards equation. The numerical model was verified through comparison with published solutions of Philip and with the results of laboratory experiments on a well-graded crushed dune sand. It was found that infiltration rates may increase with time in response to rapid rates of increase in water depth. Conditions under which this will occur were identified. (Sims-ISWS)
W80-04817

TRAVELING WAVE SOLUTIONS OF SATURATED-UNSATURATED FLOW THROUGH POROUS MEDIA,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Water Resources Research, Vol 16, No 1, p 117-122, February 1980. 9 Ref.

Descriptors: *Soil water, *Soil water movement, *Porous media, *Model studies, Mathematical models, Flow, Saturated flow, Unsaturated flow, Hydraulic conductivity, Infiltration, Darcys law, Gravity, Traveling wave solution.

Traveling wave solutions to the problem of saturated-unsaturated flow of water through a uniform porous medium were derived, and the regularity properties of the solutions were studied. It was found that a singularity occurs in the higher-order derivatives of flux with respect to the space coordinate in the solutions at water tables and that the water tables can be generally interpreted as propagating acceleration waves of the nth order, where n is a positive integer. (Sims-ISWS)
W80-04819

PERCOLATION THEORY AND MODELS OF UNSATURATED POROUS MEDIA,
National Inst. for Physical Planning and Construction Research, Dublin (Ireland).
J. M. Golden.
Water Resources Research, Vol 16, No 1, p 201-209, February 1980. 1 Fig, 37 Ref, 1 Append.

Descriptors: *Percolation, *Porous media, *Theoretical analysis, *Model studies, Mathematical models, Soil water, Soil water movement, Infiltration, Pores, Porosity, Hysteresis, Wetting, Drying, Statistics, Probability.

Concepts from percolation theory were applied to a model of unsaturated flow through porous media. This approach in principle allows one to build into the model aspects of the topological structure of pore space. At a very general level the input of results from percolation theory gives a relationship between minimum and maximum saturation values for a medium which should be experimentally checkable, though probably not without sophisticated techniques. Also, it gives some qualitative insight into known properties of unsaturated flow. Furthermore, there emerges a way of looking at the phenomenon of hysteresis that is quite different from the standard approach. This aspect was explored in some detail, and two possible new models were presented. A subsidiary result obtained from the detailed model used is that in a simple pore model the inclusion of a pore length parameter, statistically correlated with pore radius, is equivalent, at least in a restricted sense, to incorporating into the model the concept of tortuosity. (Sims-ISWS)
W80-04825

2H. Lakes

WINTER LIMNOLOGICAL CONDITIONS IN A PRAIRIE POTHOLE LAKE AND THE APPLICATION OF MOLECULAR OXYGEN,
South Dakota Cooperative Fishery Research Unit, Brookings.
R. A. Fike.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180805, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, April 1979. Applegate, R. L., principal investigator. 70 p, 14 Fig, 5 Tab, 32 Ref. OWRT A-059-SDAK(1), 14-34-0001-7088.

Descriptors: *Oxygenation, *Limnology, *Winterkilling, *Iced lakes, South Dakota, Eutrophication, Lake stages, Phytoplankton, Biochemical oxygen demand, Metabolism, Hydrogen sulfide, Ice cover, Snow cover, Light penetration, Dissolved oxygen, Chlorophyll.

The use of molecular oxygen aeration under the ice cover as a method to prevent winterkill in Round Lake, South Dakota, was evaluated during

the winter of 1977-1978. Physical, chemical and biological limnological conditions are documented for the period. Round Lake and other shallow eutrophic pothole lakes in South Dakota often suffer winterkill due to their high level of nutrients that promote rapid phytoplankton growth in summer. These phytoplankton die and decay rapidly consuming dissolved oxygen by catabolic processes in winter when the ice and snow cover prevents them from getting light. During the winter studied, the ice and snow cover was formed by December 20 and after that date phytoplankton numbers and chlorophyll concentration decreased. After January 19 dissolved oxygen declined to anoxic conditions and hydrogen sulfide gas levels peaked on February 12. Measurement of the community respiration by the diel oxygen method showed that it declined to a low on January 11 and 12 while water biochemical oxygen demand increased. A molecular oxygenation apparatus was used with three different strategies to release 711,400 liters of oxygen under the ice cover. While this oxygenation did have an effect on reversing the chemical and biological interactions leading to the lake's anoxic conditions, it was not successful in preventing winterkill. Calculations of total lake oxygen demand for the winter studied (which was severe) showed a demand of 1.05 x 10 to the 8th power liters of oxygen which would require an expenditure of $70,000 to $350,000 to prevent winterkill. (Seigler-IPA)
W80-04812

SOME LIMITATIONS OF WATER QUALITY MODELS FOR LARGE LAKES: A CASE STUDY OF LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-04818

VERTICAL MIXING INDUCED BY WIND AND A ROTATING SCREEN IN A STRATIFIED FLUID IN A CHANNEL,
Technion--Israel Inst. of Tech., Haifa.
E. Kit, E. Berent, and M. Vajda.
Journal of Hydraulic Research, Vol 18, No 1, p 35-58, 1980. 16 Fig, 27 Ref.

Descriptors: *Mixing, *Laboratory tests, *Entrainment, *Bodies of water, *Hydraulic models, Open channels, Flow characteristics, Stratification, Winds, Boundary processes, Circulation, Stratified flow, Saline water-freshwater interfaces, Interfaces, Water circulation, Shear stress, Analytical techniques, Methodology, Analysis, Theoretical analysis, Distribution patterns, Flow profiles, Mathematical models, Velocity, Profiles, Vertical mixing, Moving screens, Entrainment rate, Two layer fluid.

An experimental investigation of vertical mixing induced by wind or by a screen which moved horizontally over the water surface was carried out in a wind-wave channel. It was found that in the wind-wave channel the entrainment rate due to the shear stress which was exerted on the water surface by the moving screen was two orders of magnitude smaller than the one obtained in similar experiments which were carried out in an annular tank. The entrainment rate in the wind-induced mixing experiments was one order of magnitude larger than that found in the experiments with the horizontally moving screen, both carried out in the same channel. The explanation of these differences is based on the analysis of the flow patterns in the mixed layer in both systems. Results of the current experiments with the wind-induced entrainment seem to be applicable to water bodies of limited size, such as solar ponds. Since the influence of internal seiches was not the subject of the current research, the main results of this work could be used only for the estimation of the lower limit of the entrainment rate in the real bodies. (Humphreys-ISWS)
W80-04837

TECHNIQUES FOR EXPLORING AND PRESENTING DATA APPLIED TO LAKE PHOSPHORUS CONCENTRATION,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 7C.
W80-04843

WIND-DRIVEN CIRCULATION IN SMALL SHALLOW LAKES: LABORATORY AND COMPUTATIONAL EXPERIMENTS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
A. Giorgini, and D. D. Gray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180789, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 128, April 1980. 103 p, 44 Fig, 3 Tab, 28 Ref, 1 Append. OWRT A-048-IND(2).

Descriptors: *Lakes, *Winds, *Ponds, *Lake sediments, *Circulation, *Fourier analysis, Air circulation, Bathymetry, Sediments, Bottom sediments, Sediment-water interface, Bodies of water, Wind pressure, Effects, Water circulation, Model studies, Laboratory tests.

The research deals mainly with laboratory experiments and computational experiments. The laboratory experiments present the circulation patterns caused by different winds in two lake models built in the wind tunnel: a paraboloidal lake and a reduction of the Blackbird Pond, near West Lafayette. The experiments were executed in order to have controlled standards of comparison with the numerical experiments. The computational part of the research has been performed by using the Fast Fourier Transform algorithm technique. This was considered necessary because of the high sensitivity of sediments patterns to small velocity errors. A detailed theoretical background for the simulation is presented and several numerical experiments are performed: on the paraboloidal lake, on the Blackbird Pond bathymetry, and on a special bathymetry for which an exact solution has been found. The comparison of the laboratory experiments with the numerical experiments shows agreement, but some local deviation. This is attributed to the spatial variation of eddy viscosity in the laboratory experiment, not matched by the constant value in the numerical experiments.
W80-04870

THE ACID-BASE BALANCE IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg.
C. Brosset.
Technical Report B 540, February 1980, 21 p, 3 Fig, 5 Tab, 4 Ref.

Descriptors: *Lakes, *Acid-base equilibrium, *Methodology, *Volumetric analysis, Hydrogen ion concentration, Acidity, Alkalinity, Fulvic acid, Analytical techniques, Carbonic acid, Carbon dioxide, Weak acids, Acidity constants, Equations.

Previous studies of the determination of the concentration and acidity constants of acids in natural waters are extended to emphasize the determination of the total acid-base balance in nine lake water samples taken in January-February 1978. Using a simple titration method, the acid-base system may be divided into three parts; (1) strong acid or base, (2) weak acids, primarily fulvic acid, and (3) carbonic acid. At least two different weak acids can be determined if their acidity constants are within 0.001-0.000001 and if no other weak acids are present. All samples contained essentially the same acid with an acidity constant near 0.00002-0.00003. Two samples contained an additional acid with the constant 0.0003-0.0004. This weak acid determination makes the determination of strong base/acid concentrations in the sample possible, and subsequently, carbonic acid concentration can be calculated by using the pH value. It is concluded that excess strong base observed is generally in good agreement with previously measured alkalinity. In the cases where zero alkalinity values were reported, excess strong acid could be measured. When excess base is present, high values of H2C02 indicates the possibility of supersaturation with C02. Interestingly, this increase in supersaturation increased with concentration of the strong base and in most cases of the fulvic acid at about the same pH. No simple explanation is offered for these observations, nor is it clear why excess C02 is not easily removed, even from acidified lake water samples when they contain fulvic acid. (Luedtke-Wisconsin)
W80-05016

FRESHWATER PHYTOPLANKTON FROM THE NARSSAQ AREA, SOUTH GREENLAND,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
G. Nygaard.
Botanisk Tidsskrift, Vol 73, No 3-4, p 191-238, 1978. 378 Fig, 19 Tab, 141 Ref.

Descriptors: *Greenland, *Phytoplankton, *Lakes, *Surveys, Narssaq(Greenland), Algae, Chlorophyta, Chrysophyta, Diatoms, Density, Diversity, Oligotrophy, Population, Productivity, Sampling, Dinobryon, Freshwater.

Phytoplankton of 17 lakes situated in the Narssaq Area of South Greenland was studied as part of a detailed geo-chemical and ecological investigation. Chrysophyceae, especially a large variety of Dinobryon species make up the greater part of the plankton in most of the lakes. Chlorophyceae, represented by the chlorococcalean genera Coenococcus and Crucigeniella and by several species of the desmid Staurodemus, were prevalent or subdominant in some of the lakes. Blue-green algae is rarely found in these lakes. Diatoms play a more important role in the plankton communities than dinoflagellates. The ultra-oligothrophic character of the lakes is revealed by the low densities varying from 24 to 70,000 algal individuals and colonies/litre of surface water. Lakes in the southern part of the Ilimaussaq intrusion were extremely low in plankton, while lakes in the adjacent area displayed far greater densities. These differences may be due to the different chemical composition and physical properties of the rocks in the respective regions. In particular, the more massive, fine-grained rocks in Region 3 are covered with a dense vegetation which provides vital organic compounds to lake waters. Though these undisturbed arctic lakes are low in phytoplankton density, an exceptional diversity of species exists. Sixteen new taxons and 82 questionable taxons were reviewed. (Luedtke-Wisconsin)
W80-05018

A CONSIDERATION OF TROPHIC DYNAMICS IN SOME TALLGRASS PRAIRIE FARM PONDS,
Kansas State Univ., Manhattan. Div. of Biology.
For primary bibliographic entry see Field 5C.
W80-05025

LAKE ECOSYSTEMS: A POLYHEDRAL DYNAMICS REPRESENTATION,
New York Univ., NY. Dept. of Computer Applications and Information Systems.
For primary bibliographic entry see Field 5C.
W80-05040

2I. Water In Plants

WATER STORAGE ON FOREST FOLIAGE: A GENERAL MODEL,
Oregon Univ., Eugene. Dept. of Biology.
W. J. Massman.
Water Resources Research, Vol 16, No 1, p 210-216, February 1980. 4 Fig, 7 Ref, 1 Append. NSF DEB78-03583.

Descriptors: *Water storage, *Forests, *Mathematical models, Interception, Forest watersheds, Foliar, Fog, Model studies, Rain, Evaporation, *Forest foliage, *General model, Dimensionless parameters, Drip rate, Water storage capacity, Model predictions, Storage process, Dynamical model.

A model for the prediction of water accumulation on forest foliage was presented. It is general enough to include linear, exponential, or logarith-

mic forms for the buildup of accumulated water and to go from any one of these three limiting forms to any other in a continuous manner by varying a single dimensionless parameter. This equation unifies into a single form many other models used to predict water accumulation on forest foliage. An exploration of the underlying assumptions relating drip rate to interception intensity showed how these other models differed from one another. Evaporation was included in the model by using another dimensionless parameter which may be useful in regions where only an approximate estimate of the evaporation rate was available. To include evaporation correctly into the model, it was necessary to define the water storage capacity first in order to interpret the model predictions. (Roberts-ISWS)
W80-04826

FORESTS AND FLOODING WITH SPECIAL REFERENCE TO THE WHITE RIVER AND OUACHITA RIVER BASINS, ARKANSAS,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Bedinger.
Geological Survey Water-Resources Investigations 79-68 (open-file report), 1979. 27 p, 4 Fig, 3 Tab, 78 Ref.

Descriptors: *Forests, *Floods, *Arkansas, *Deciduous trees, *Geomorphology, Hydrologic cycle, Plant physiology, Ecology, Submergence, Soil moisture, Drainage effects, Soil-water-plant relationships, Flood frequency, Flood plains, Model studies, Sampling, Sites, Annual flood, Benthic flora, Regulated flow, Post-impoundment, White River basin(Ark), Ouachita River basin(Ark).

The observed response of trees to hydrologic stress and distribution of trees in relation to habitat indicate that flooding, ground-water level, soil moisture, soil factors, and drainage characteristics exert a strong influence on bottomland forest species distribution. The dominant hydrologic factor influencing the distribution of bottomland tree species is flooding. Individual tree species are distributed as a function of frequency and duration of flooding. In the lower White and Ouachita River basins, the flood plains consist of a series of terraces, progressively higher terraces having less frequent flooding and less duration of flooding, and a significantly different composition of forest tree species. The sites studied can be divided into four basic groups and several subgroups on the basis of flood characteristics. On Group I (water hickory-overcup oak) sites, flooded near annually 32 to 40 percent of the time, the dominant species are water hickory and overcup oak. On Group II (nuttall oak) sites, flooded near annually 10 to 21 percent of the time, a more varied flora exists including nuttall oak, willow oak, sweetgum, southern hackberry, and American elm. The third group (Group III or shagbark hickory-southern red oak) of sites is flooded at intervals from 2 to 12 years. This group includes southern red oak, shagbark hickory, and black gum. The presence of blackjack oak in addition to Group III species marks Group IV (not flooded in historic time). (Kosco-USGS)
W80-04854

SIMULATION OF WETLANDS FOREST VEGETATION DYNAMICS,
Geological Survey, Reston, VA. Water Resources Div.
R. L. Phipps.
Ecological Modelling, Vol 7, p 257-288, 1979. 11 Fig, 12 Tab, 24 Ref.

Descriptors: *Computer models, *Wetlands, *Forests, *Vegetation, *Flood frequency, Computer programs, Model studies, Hydrologic data, Trees, Soil-water-plant relationships, Flood control, Lumbering, Dendrochronology, Ecological distribution, Environmental effects, Wildlife management, Arkansas, *White River National Wildlife Refuge(Ark), SWAMP.

A computer program, SWAMP, was designed to simulate the effects of flood frequency and depth to water table on southern wetlands forest vegetation dynamics. By incorporating these hydrologic characteristics into the model, forest vegetation and vegetation dynamics can be simulated. The model, based on data from the White River National Wildlife Refuge near Dewitt, Arkansas, 'grows' individual trees on a 20 by 20 meter plot taking into account effects on the tree growth of flooding, depth to water table, shade tolerance, overtopping, crowding, and probability of death and reproduction. A potential application of the model is illustrated with simulations of tree fruit production following flood-control implementation and lumbering. (Kosco-USGS)
W80-04860

2J. Erosion and Sedimentation

A STOCHASTIC MODEL FOR PARTICLE SORTING AND RELATED PHENOMENA,
Geological Survey, Lakewood, CO. Water Resources Div.
B. M. Troutman.
Water Resources Research, Vol 16, No 1, p 65-76, February 1980. 11 Fig, 14 Ref.

Descriptors: *Sediments, *Sediment transport, *Particle size, *Model studies, Mathematical models, Stochastic processes, Rivers, Streams, Tributaries, Sediment sorting, Bottom sediments, Sedimentology.

A number of factors contribute to the variability in particle size distribution with position, or sorting, that is often observed in natural channels. Several of these factors are readily examined by using stochastic models of particle movement along a streambed. If particle position and particle size are treated as jointly distributed random variables, then sorting is reflected in the fact that the conditional distribution of size given position depends on the value of position. This conditional distribution is most easily derived by first postulating the form of the conditional distribution of position given size and of the marginal size distribution. Further, the effect of mixing particles from two or more distinct sources can be considered by examining the joint distribution of three random variables: size, position, and source. This is useful in predicting size distribution downstream from the point where a tributary enters a channel. Longitudinally varying transport conditions, which also contribute significantly to sorting, are conveniently modeled with a nonhomogeneous Poisson process. Here it is assumed that the particle motion consists of a sequence of steps of random length, each step followed by a rest period of random duration. It is the number of particle rest positions as a function of distance from the initial position that obeys a Poisson process, so the proposed model allows for systematic change of the step length and rest duration distributions with position downstream. (Sims-ISWS)
W80-04815

THEORETICAL APPROACH TO PREDICTION OF LOCAL SCOUR AROUND BRIDGE PIERS,
Cambridge Univ. (England). Dept. of Engineering.
C. J. Baker.
Journal of Hydraulic Research, Vol 18, No 1, p 1-12, 1980. 4 Fig, 7 Ref.

Descriptors: *Scour, *Piers, *Theoretical analysis, *Mathematical models, Analytical techniques, Erosion, River beds, Alluvial channels, Flow characteristics, Vortices, Analysis, Sediments, Movement, Sediment transport, Depth, Local scour, Bridge piers, Clear water scour.

Formulae were derived that relate the equilibrium scour depth upstream of cylindrical bridge piers caused by horseshoe vortex systems to various flow parameters. Assumptions were made concerning the vortex size and shape during the scouring process and concerning the forces on particles within the scour hole. The derived formulae were found to be in good agreement with experimental results. (Humphreys-ISWS)
W80-04835

CHEMICAL AND SEDIMENT MASS TRANSFER IN THE GODAVARI RIVER BASIN IN INDIA,
Jawaharlal Nehru Univ. New Delhi (India). School of Environmental Sciences.
G. Bikshamaiah, and V. Subramanian.
Journal of Hydrology, Vol 46, No 3/4, p 331-342, April 1980. 4 Fig, 7 Tab, 21 Ref.

Descriptors: *Mass transfer, *Chemicals, *Sediments, *Sediment transport, Rivers, Watersheds(Basins), Runoff, Rainfall, Evaporation, Monsoons, Suspended solids, Dissolved solids, Salts, Discharge(Water), Hydrology, Sedimentology, *India, *Godavari River(India).

Mass transfer in the Godavari River is predominantly monsoonal since 95% of the total annual load is transported in the wet season. The annual denudation rate varies from one part of the basin to the other, but the basin as a whole is being eroded at a rate higher than that of the world global average. This may be due to the fact that 85% of the basin is covered by intensive human activity. While geology is a controlling factor from a quality point of view, discharge and elevation control quantitatively the annual mass transfer into the Bay of Bengal. The sediment load, representing physical weathering, is about seven times that of the chemical load. Monthly and annual variations in mass transfer as a function of time and space have been observed in the river basin. The annual mass transfer of the river is about 10% of that of the Himalayan drainage system. (Sims-ISWS)
W80-04845

SEDIMENT DISCHARGE IN THE SANTA CLARA RIVER BASIN, VENTURA AND LOS ANGELES COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. P. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-162951, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-78, August 1979. 51 p, 20 Fig, 8 Tab, 16 Ref.

Descriptors: *Sediment discharge, *River basins, *California, *Sediment yield, *Streamflow, Sampling, Measurement, Estimating, Sediment transport, Sediment load, Particle size, Bed load, Erosion control, Beaches, Hydrologic data, *Santa Clara River basin(Calif).

Sediment data collected in the Santa Clara River in California basin, during the 1967-75 water years were analyzed to determine the particle size and quantity of sediment transported past three gaging stations. The total sediment discharge of the basin, computed from records of Santa Clara River at Montalvo for water years 1968-75, was 63.5 million tons, of which 59.5 million tons was carried in suspension and an estimated 4 million tons was transported as unsampled sediment discharge. About 17.7 million tons, or 28 percent of the total sediment discharge, was coarse sediment (particles larger than 0.062 millimeter). Most of the sediment was transported during only a few days of flood-flow each year. During the 1968-75 water years, approximately 55 percent of the total sediment was transported in 2 days and 92 percent was transported in 53 days. The long-term (1928-75) average annual sediment discharge of the Santa Clara River at Montalvo is estimated at 3.67 million tons. Of that quantity, 2.58 million tons consisted of fine sediment and 1.09 million tons consisted of coarse sediment. A sediment budget for the Santa Clara River basin was estimated for sediment discharges under both natural and actual conditions. The major difference between natural and actual sediment discharges of the Santa Clara River basin is the sediment intercepted upstream from Lake Piru. The combined trap efficiency of Lake Piru and Pyramid Lake approaches 100 percent. Sediment deposited in these reservoirs resulted in about a 6-percent reduction of sediment to the Santa Clara River basin during the historical period (1928-75) and a 12-percent reduction during the period most affected by dams (1953-75). Sediment losses to the basin by gravel mining, diversion of flows, and interception of sediment in the Castaic Creek basin

resulted in additional reductions of 2 percent during the period 1928-75 and 4 percent during the period 1953-75. (Kosco-USGS)
W80-04856

SEDIMENT TRANSPORT BY THE WHITE RIVER INTO MUD MOUNTAIN RESERVOIR, WASHINGTON, JUNE 1974-JUNE 1976,
Geological Survey, Seattle, WA. Water Resources Div.
L. M. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A075 139, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-133, June 1979. 26 p, 7 Fig, 2 Tab, 5 Ref.

Descriptors: *Sediment transport, *Streamflow, *Reservoirs, *Washington, *Data collections, Discharge(Water), Sampling, Bed load, Particle size, Aggradation, Suspended load, Sediment discharge, *White River(Wash), *Mud Mountain Reservoir(Wash).

This reconnaissance evaluation of the sediment transport by the White River into the Mud Mountain Reservoir, in Washington, during the period June 1974-June 1976 showed that the river transported 430,000 tons of suspended sediment into the reservoir during the first year of the study and 1,400,000 tons in the second year. Daily mean suspended-sediment concentrations generally were less than 500 milligrams per liter; the highest daily mean concentration was 6,200 milligrams per liter on December 1, 1975. A good relation exists between daily suspended-sediment discharge and daily mean water discharge except during periods of runoff from glacial melt. Data from samples obtained by the use of the Helley-Smith bedload sampler indicate that the bedload measured using the sampler is about 4 percent of the suspended-sediment discharge. Potential deposition in the reservoir was estimated at 750 acre-feet during the 2 years of study. (Kosco-USGS)
W80-04857

SIMULATION OF RESERVOIR AND LAKE SEDIMENTATION,
Kansas Water Resources Research Inst., Manhattan.
W. M. Merrill, and Y. M. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182801, Price codes: A08 in paper copy, A01 in microfiche. Project Completion Report, April 1980. 144 p, 17 Fig, 7 Tab, 30 Ref, 2 Append. OWRT B-036-KAN(1), 14-31-0001-4085.

Descriptors: *Sedimentation, *Lake sediments, *Reservoir silting, *Sediment transport, Silt, Clay, Sediment distribution, Model studies, Simulation analysis, Computer programs, Alluvial streams.

In the course of an investigation of sedimentation in reservoirs, two lakes Decatur in Central Illinois and Kanopolis in west central Kansas, have been used to develop a model of reservoir sedimentation and two computer programs to simulate it. Data from a third lake, Harry E. Strunk in southwestern Nebraska, have been gathered to be used for further testing of the programs. Basis for the model is a statement of general relationships formulated by Sloss (1962) to describe sedimentation in shallow marine basins, modified to apply to relatively small freshwater bodies (Merrill and Chang, 1973). In its modified form, the statement serves as foundation for quantitative and semiquantitative expressions that are translated into algorithms to simulate reservoir processes. The model and programs are appropriate only for reservoirs established on alluvial streams in which an essentially unlimited supply of sediment, 90 percent or more of which is silt and clay and at least 30 percent of which is clay of two microns or less, can be assured. Movement of the water-sediment mixture, deposition, erosion, compaction, and the passage of time are incorporated in the simulation. Results of the simulation compare favorably to observed configurations in the reservoirs modeled. At least one of the hypotheses proposed to explain distribution of sediment in reservoirs probably can successfully be tested with these programs.
W80-05010

2K. Chemical Processes

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2A-2. SOUTH FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04848

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2B. SOUTH FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-04849

DETERMINATION OF TRACE ELEMENTS IN NATURAL WATERS BY THE D.C. ARGON PLASMA, MULTIELEMENT ATOMIC EMISSION SPECTROMETER (DCP-MAES) TECHNIQUE,
Colorado State Univ. Fort Collins. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W80-04858

WELL MAINTENANCE PROGRAMS CAN PREVENT FAILURES,
UOP, Inc., St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W80-05084

2L. Estuaries

DISPERSION IN TWO-LAYER STRATIFIED WATER BODIES,
National Technical Univ., Athens (Greece). Applied Hydraulics Lab.
G. C. Christodoulou, and J. J. Connor.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15342, p 557-573, April 1980. 9 Fig, 19 Ref, 1 Append.

Descriptors: *Stratified flow, *Dispersion, *Mathematical models, *Tidal waters, Bays, Mixing, Stratification, Water quality, Distribution patterns, Model studies, Analytical techniques, Diffusion, Theoretical analysis, Numerical analysis, Finite element analysis, Bodies of water, Estuaries, Onsite investigations, *Massachusetts Bay, Two-layer model, Model verification.

A finite element model was developed for the numerical prediction of the dispersion process in a strongly stratified water body idealized as a two-layer system. The physical processes of mixing through the density interface and horizontal dispersion were discussed. Numerical integration in time is based on an implicit iterative trapezoidal scheme. Results for one-dimensional counterflow conditions were verified with analytical solutions The model was applied to a large dispersion experiment in Massachusetts Bay. Taking into account the initial spreading of the source and the uncertainties about the velocity field, good qualitative agreement was observed with respect to the location and peak values of the plume. The development of numerical techniques is outgrowing the present ability to define realistic inputs as well as the basic knowledge of some of the physical processes involved. Further fundamental research is needed for better understanding of the turbulent mixing process in stratified environments. Also, field monitoring programs are required to provide reliable inputs, primarily on the behavior of the interface along open boundaries. (Humphreys-ISWS)
W80-04833

VERTICAL MIXING INDUCED BY WIND AND A ROTATING SCREEN IN A STRATIFIED FLUID IN A CHANNEL,
Technion--Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 2H.
W80-04837

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF REVERSE OSMOSIS MEMBRANE FOR SEAWATER DESALINATION,
Membrane Systems, Inc., San Diego, CA.
R. G. Sudak, J. B. Bott, R. L. Fox, S. J. Gagner, and M. E. McKee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182090, Price codes: A06 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, September 1979. 112 p. OWRT C-80278-S(No 8523)(1), 14-34-0001-8523.

Descriptors: *Reverse osmosis, *Membranes, *Sea water, *Desalination processes, *Membrane processes, Polyethylenimine, Isophthaloyl chloride, Polyimide membranes, Poly(Epichlorohydrin-secondary diamines).

Composite reverse osmosis membranes were formed with a polysulfone porous substrate. The membrane barrier layer was formed on this substrate by the interfacial polycondensation of polyethylenimine and isophthaloyl chloride. The barrier layer was shown to be capable of single stage seawater desalination in that selected membrane samples had a flux of 17 GFD and a rejection of 99% when operated on a feed-water containing 35,000 mg/l of sodium chloride at 800 psig and 75F . Manufacturing yields of this membrane would be expected to be low due to the poor quality of fabric carrier material which is available. Asymmetric polyimide membrane was developed further by optimization of casting formulations and conditions. When tested under seawater conditions as described above, the best results obtained were 5.8 GFD and 98.4% rejection. A composite membrane barrier layer was formed on polysulfone substrate interfacially with poly (epichlorohydrin-secondary diamines) and isophthaloyl chloride. The best results obtained with this membrane under seawater conditions were 9.6 GFD and 94% rejection.
W80-04802

3B. Water Yield Improvement

LEGAL SYSTEM REQUIREMENTS TO CONTROL AND FACILITATE WATER AUGMENTATION IN THE WESTERN UNITED STATES,
For primary bibliographic entry see Field 6E.
W80-04995

IMPROVING YIELDS OF OPEN WELLS IN CONSOLIDATED ROCKS USING EXTENSION DRILLING TECHNIQUES,
Geraghty and Miller, Inc., Annapolis, MD.
For primary bibliographic entry see Field 8A.
W80-05057

3C. Use Of Water Of Impaired Quality

APPLICATION OF CONTINUOUS HYDROLOGIC MODELING TO EVALUATE AND DESIGN WASTEWATER LAND DISPOSAL OR EVAPORATION SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
J. J. Zovne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181050,

Price codes: A04 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Kansas State University Project Completion Report, March 1980, 48 p, 11 Fig, 8 Tab, 7 Ref, 2 Append. OWRT A-090-KAN(1), 14-34-0001-8018.

Descriptors: *Hydrology, *Design, Lagoons, Evaporation, *Ponds, *Kansas, Monitoring, Water level fluctations, Soil moisture, Runoff, Percolation, *Water reuse, *Hydrologic model, *Land treatment systems, *Municipal wastewater, Wastewater disposal, *Irrigation.

The hydrologic design of land treatment systems has largely been accomplished by annual or semi-annual estimates of the disposition of the input wastewater load. The operation of these systems is, however, dependent upon daily variations in precipitation, evaporation, and land treatment/irrigation area water management. The subject of this report is a hydrologic model which has been developed to design these systems based upon a continuous simulation of the daily water budget of a storage pond and irrigation disposal area system. The user of this program would need to identify a nearby weather station having long-term daily precipitation and temperature records. He would also need to identify the soil type in the disposal area, and specify the storage pond size, the irrigation disposal rate, the crop or cover on the disposal area, and the level of available soil moisture when irrigation ceases. The model monitors the daily pond level fluctuations and overflows; soil moisture, runoff, and percolation in the disposal area; and gives monthly and annual summaries of all hydrologic variables. By manipulating sizes and rates, the user can design an optimal system. An example is given for the Kinsley, Kansas, system. The application of the model to evaluating State of Kansas nondischarging lagoon design procedures is also presented.
W80-04804

WASTEWATER RECYCLING: DEVELOPMENT OF PLANT DISEASE IN AN OLD FIELD ECOSYSTEM,
Michigan State Univ., East Lansing. Dept. of Botany.
K. Epstein, K. Ditz, and G. R. Safir.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181043, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, April 1980. 37 p, 9 Fig, 10 Tab, 36 Ref. OWRT A-097-MICH(1), 14-34-0001-8024.

Descriptors: *Wastewater irrigation, *Plant disease, Pathogens, Coleosporium solidaginis, Erysiphe cichoracearum, Phyllachora graminis, Helminthosporium, Sp, *Return flow, Recycling, Water pollution effects, *Filter sterilized wastewater, *Tapwater, Old field.

During 1978 and 1979, the threat of plant disease in a wastewater irrigation field dominated by goldenrod and quackgrass was assessed. Pathogens that were abundant in the wastewater irrigated areas, Coleosporium solidaginis, Erysiphe cichoracearum, Phyllachora graminis and Helminthosporium sp., alternate on economically important hosts. The increased disease in the irrigated areas seemed mainly due to moisture and disease severity was reduced by a midseason harvest. Levels of plant pathogens in the wastewater were apparently low since wounded seedlings of 12 varieties of 7 field crops soaked in wastewater remained healthy. There was no difference in the survival of Alternaria tensuis or Stemphylium sarcinaeforme after 24 days in filter sterilized wastewater or tapwater, but both Erwinia herbicola and E. atroseptica survived better after 24 hrs in wastewater than in tapwater.
W80-04805

WASTE WATER FOR CROP IRRIGATION.
Ground Water Age, Vol 14, No 7, p 23, 28, March, 1980.

Descriptors: *Irrigational practices, *Waste water disposal, Sewage disposal, Water spreading, Crop response, Municipal wastes, Ground water, Water quality, Environmental effects, Economics, Safety.

The use of municipal effluent for agricultural purposes is becoming a popular means of waste water disposal. Researchers at Texas Tech University Water Resources Center, under an EPA contract, will provide information on the long- and short-term effects of sewage on crops, soils, the quality and quantity of ground water, and the economics of the process. This information will be used to structure guidelines for cost effective, productive and environmentally safe use of sewage water for land application, and to evaluate existing EPA guidelines. (Purdin-NWWA)
W80-04842

AQUIFERS STORE ENERGY.
Geotimes, Vol 25, No 3, p 28-29, March, 1980. 1 Fig.

Descriptors: *Aquifers, *Energy storage, *Cooling water, *Heated water, Non-consumptive use, Power plants, Peaking capacity, Heat balance.

Battelle's Pacific Northwest Laboratory will test the feasibility of using aquifers to store hot or cold water for later retrieval for heating or cooling. Advantages of aquifer energy storage include: (1) more efficient use of heat from solar energy and other alternative-energy systems that vary with seasonal or weather changes; (2) waste heat from factories or electric power plants is recovered, (3) cooling towers might be eliminated for some power plants; (4) it is non-consumptive use of water; (5) non-potable ground water can be used; (6) up to 95% of the original heat can be retrieved; (7) it can be used in conjunction with coal-fired heating systems to meet high energy demands during peak periods. Two other field studies are currently underway at Auburn University and the University of Minnesota, Minneapolis. A major conclusion of Battelle's program is that aquifer energy storage is ideal for a complex of adjacent buildings or a small community. While it would not have direct application on a regional basis, it could ease the regional power supply situation by helping reduce energy needed to offset seasonal changes in power demands. (Purdin-NWWA)
W80-04940

DRILLING FOR ENERGY ALTERNATIVES.
Ground Water Age, Vol 14, No 6, p 25, 44, February, 1980.

Descriptors: *Geothermal studies, *Drilling, *Geopressured aquifers, *Louisiana, Thermal water, Methane, High pressure, Well spacing, Land subsidence, Brine disposal, Oil wells, Coastal plains, Bayous.

According to the Louisiana Department of Natural Resources, as much as forty million gallons per well per day of geopressured water at temperatures from 250-400F can be withdrawn from the coastal zone aquifers. In addition, it is estimated that over 13.6 trillion standard cubic feet of dissolved methane gas is contained in these aquifers, and downhole pressures may attain one psi per foot of depth. Test wells are expected to exceed 10,000 feet in depth and cost about $10 million each. Disadvantages of geopressure drilling and production are: (1) wells must be widely spaced; (2) land subsidence could occur; (3) brine disposal may cause pollution; and (4) oil and gas production may be reduced. (Purdin-NWWA)
W80-04949

SALTY WASTE WATER--AN IRRIGATION SOURCE..
Ground Water Age, Vol 14, No 6, p 28, 30, February, 1980.

Descriptors: *Impaired water use, *Return flow, *Irrigation water, Water reuse, Brackish water, Cotton, Land reclamation, Leaching, Drainage, Drainage water, Saline soils, Halophytes, Salt tolerance.

A four-year study near Bakersfield, California will determine the yield of cotton irrigated with saline agricultural drainage wastewater, evaluate the extent of salt buildup in the soil, and determine if the soil can be desalinated by irrigating with low-salinity water. One reason for this study is the buildup of brackish irrigation water in the San Joaquin Valley. A drainage canal will eventually take the waste waters out of the valley, but to reduce the volume of water and the size of the canal, researchers are finding ways of using the water on a succession of salt tolerant crops. Under study will be low salinity water (200 ppm), high salinity water from a brackish well (5,800 ppm), and a mixture of the two (3000 ppm). Application rates will be adjusted to the salinity level of the water. Higher salinity water will require an extra amount which leaches salt below the root zone to minimize salt damage to the plants. (Purdin-NWWA)
W80-04955

USE OF THE WATERS OF THE COLORADO RIVER IN MEXICO: PERTINENT TECHNICAL COMMENTARIES,
For primary bibliographic entry see Field 6E.
W80-04985

THE COLORADO RIVER SALINITY AGREEMENT OF 1973 AND THE MEXICALI VALLEY,
Arizona State Univ., Tempe.
For primary bibliographic entry see Field 6E.
W80-04986

A THEORETICAL ANALYSIS OF MINUTE 242,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-04988

3D. Conservation In Domestic and Municipal Use

ANALYSIS OF THE WATER RATE STRUCTURE AS A MANAGEMENT OPTION FOR WATER CONSERVATION,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. W. Male, C. E. Willis, F. J. Babin, and C. J. Shillito.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182595, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts, Publication No 112, 1979. 89 p, 4 Fig, 5 Tab, 35 Ref, 3 Append. OWRT-A-125-MASS(1), 14-34-0001-97023.

Descriptors: *Water conservation, *Water rates, *Pricing, *Water costs, *Cost analysis, Cost allocation, Cost-benefit analysis, Marginal costs, Water consumption, Average costs, Declining average costs, Elasticity of water demand, Water management(Applied), Water meters, Meter reading routing, *Potable water.

The objective was to assess the potential for residential water conservation by altering the price structure. This document reports on the general consumer responsiveness to variations in water price structure and on an application to one case study. Consumer responsiveness was assessed by applying an ordinary least squares regression analysis to three different functional forms each containing the water price, median income, number of persons per meter, and population density as independent variables. The analyses yielded a range of price elasticities, with the exponential functional form yielding a median value of -.37. Results of the general analysis were applied to a case study to estimate the degree of consumer responsiveness to three different rate structures. Results showed an estimated reduction of residential demand of approximately 15 percent for a three month water short period. In addition to the demand estimates several practical matters were considered which would affect the implementation of water conserving rate structures. These include equity among users (including non-residential) and water meter reading and billing practices. A systematic method

for determining meter reader routes was outlined and billing practices which might aid in water conservation were suggested. (Godfrey-Mass)
W80-05007

3F. Conservation In Agriculture

MANAGEMENT OF SUMMER-SEASONAL IRRIGATION WATER IN BEEF COW/CALF AGRICULTURE IN THE SIERRA NEVADA FOOTHILLS,
California Univ., Davis. Dept. of Agronomy and Range Science.
C. A. Raguse, and W. A. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180920, Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, March 1980, 6 p, 1 Fig, 3 Tab. (California Water Resources Center Project UCAL-WRC-W-495). OWRT-B-175-CAL(5).

Descriptors: *Range management, *Economic feasibility, *Economic efficiency, Grazing, *Linear programming, Model studies, Microenvironment, Conservation, *Irrigation water, *Irrigation efficiency, California, *Sierra Nevada foothills.

Efficient agricultural production in the Sierra Nevada foothills is generally achieved only through the use of the grazing animal. Economically this region has a comparative advantage, for the production of beef calves, over regions of intensive agriculture. Grazing is also an appropriate biological tool for land management in the nonagricultural interests of the general public. Use of seasonally available irrigation water for perennial and annual forages was evaluated in terms of biological yield and economic feasibility. These forages could be used to supplement winter- and spring- growing annual range. A linear programming model for resource allocation was developed. Emphasis was given to achieving maximum user-level flexibility in assigning values-such as land and forage classes, length of season and animal requirements-to the various assumptions of the model. Management practices which modify the soil-plant microenvironment can affect plant vegetative regeneration, dry matter production and symbiotic nitrogen fixation. The effects of various factors including light, temperature and phosphorous levels were studied in controlled environment facilities and in the field. (Snyder-Calif)
W80-04803

GROWTH OF SUBTERRANEAN CLOVER IN A RANGE SOIL AS AFFECTED BY MICROCLIMATE AND PHOSPHORUS AVAILABILITY. III. COMPARATIVE GROWTH OF SUBTERRANEAN AND ROSE CLOVERS AT COLD SOIL TEMPERATURES,
California Univ., Davis. Dept. of Agronomy and Range Science.
C. A. Raguse, and K. L. Taggard.
Agronomy Journal, Vol 71, p 523-528, July-August 1979. 4 Fig, 4 Tab. (California Water Resources Center Project UCAL-WRC-W-495). OWRT-B-175-CAL(6).

Descriptors: *Red clover, *Clovers, *Legumes, *Soil temperature, *Climates, *Growth rates, *Environmental control, Temperature, Rainfall, Ranges, Range management, Environmental effects, Nitrogen fixation, Soil-water-plant relationships, Winter, Range grasses.

The biological yield potential of winter annual range legumes is influenced by the timing of rainfall adequate to ensure germination. If rains are late, the establishment phase of growth must occur at cold soil and air temperatures. On low-P soils, this combination of abiotic factor constraints can limit symbiotic N fixation. Three controlled-environment experiments were conducted to compare the seedling growth of rose clover and subterranean clover on a P-deficient soil, simulating winter conditions of cold soils and low light. Comparative growth responses, especially intraplant dry matter partitioning and nodulation, were observed for several soil P availability levels. A sunlit phytotron provided a common shoot environment of seasonal (fall/winter) ambient light intensity and photoperiod, with a programmed smooth diurnal temperature cycle of 20C maximum and 5C minimum. Three independently-controlled water baths maintained soil temperature experiments at a constant 5C, a constant 10C, and a diurnal 5C to 10C alternation. Phosphorus levels were 0, 45, 90, and 180 kg/ha equivalents. Growth intervals (5 + or - 0.5 trifoliate-leaf stage), varied between 58 and 114 days. The results suggest that while the practical soil threshold temperature for overall growth is near 5C, some intraplant growth processes may proceed, but only at adequate availability levels of mineral nutrients. (Snyder-California)
W80-04814

CORN RESPONSE TO AMMONIACAL NITROGEN UNDER VARYING LEVELS OF MAGNESIUM AND POTASSIUM FERTILITY,
Delaware Univ., Newark. Dept. of Plant Science.
M. R. Teel, W. H. Mitchell, A. L. Morehart, and D. K. Brauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182124, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Completion Report, April 1980, 32 p, 17 Tab. OWRT A-039-DEL(1), 14-34-0001-8008.

Descriptors: *Crop response, *Ammonification, *Nitrogen, *Subsoil, *Experimental forms, Lime, Corn(Field), Cover crops, Rye, Irrigation, Evaluation, Magnesium, Potassium.

Eight nitrogen treatments, varying with respect to nitrogen source (ammonium versus nitrate), and method of application, were compared with corn (Zea Mays L.) under four levels of potassium (0, 50, 100 and 200 lbs. K20/acre/yr as KCl) within each of three lime regimes (no lime, dolomitic, or calcitic lime). The research was conducted during the growing seasons of 1976 - 1979. Salient data from the 1978 and 1979 seasons are reported. A randomized split-split block design was used, replicated three times, with lime sources as main plots; potassium levels as sub plots, and nitrogen treatments as sub-sub plots. Nitrogen was applied in split applications either broadcast in granular form or injected as a solution into the water system used for subsurface irrigation (SSI). Sodium nitrate (NaN03) and urea (C0-(NH-2)2) were used as sources of nitrate (N0-3) and ammonium (NH+4) nitrogen respectively. Urea was injected both with and without Nitrapyrin, (2-choro-6-(trimethyl)-pyridine, at two percent of the nitrogen rate. The level of exchangeable NH+4 found on August 8, and October 29, 1978 was significantly increased by addition of this nitrification inhibitor. Residual NH4 from the 1978 treatments increased both leaf N and dry matter production in the succeeding rye cover crop. Corn grain yields were not significantly influenced by potassium treatments due chiefly to inherently high potassium fertility on the test site. Nitrogen source effects varied with both lime and irrigation treatments.
W80-04871

THE USE OF THE CLIMATIC WATER BUDGET IN IRRIGATION SCHEDULING: IOWA,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather, and A. DeNardo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182140, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Report, July 1978. 25 p, 2 Fig, 1 Tab, 2 Append. OWRT A-040-DEL(7), 14-34-0001-9008.

Descriptors: Irrigation, *Water budget, *Irrigation programs, Iowa, *Agroclimatology, *Irrigation scheduling, Water utilization, Evapotranspiration, Precipitation(Atmospheric).

Scheduling the correct amount of supplemental irrigation is a problem facing all irrigators. While various techniques have been developed to permit calculation of time and amount of irrigation needs, most are so complex or require so many data that they cannot be evaluated by the individual farmer or irrigation operator. A simplified irrigation scheduling procedure using average information on the climatic demand for water (evapotranspiration) and the precipitation as measured at the particular irrigation site is described. While the approach can be applied anywhere, this primer provides evapotranspiration information only for Iowa. Sample worksheets for irrigation scheduling are included.
W80-04876

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE USE OF THE CLIMATIC WATER BUDGET IN WATER RESOURCES MANAGEMENT AND CONTROL,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180623, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Research Technical Completion Report, November 1979. 8 p. OWRT A-040-DEL(2), 14-34-0001-9008.

Descriptors: *Hydrologic budget, *Water balance, *Climatology, *Water management, Irrigation, Streamflow, Landfills, Leaching, Land use effects, Computer models.

Comparison of the monthly or daily climatic supply of water (precipitation) with the climatic demands for water (evapotranspiration) in a water budget accounting framework results in quantitative information on such factors as recharge of water to the water table, streamflow, irrigation need, and storage of moisture in the soil. The information is needed by planners, engineers, agriculturalists, hydrologists and others who are concerned with water resources and their modification by human or natural actions. The results of the study have been presented in a series of primers which describe how the climatic water budget can be adapted to solve particular water problems. Each of the primers is complete, containing all of the information and tables needed to evaluate the water budget along with detailed instructions on how the water budget information can be used in the particular example. Titles of the six primers are: WATBUG: A FORTRAN IV Algorithm for Calculating the Climatic Water Budget; The Use of the Climatic Water Budget in Irrigation Scheduling: Iowa; The Use of the Water Budget in Evaluating Leaching Through Solid Waste Landfills; The Influence of Land-Use Change on Water Resources; Use of the Climatic Water Budget to Estimate Streamflow; The Use of the Climatic Water Budget to Evaluate the Validity of a Precipitation Record.
W80-04872

INTERSTATE RIVER COMPACTS: IMPACT ON COLORADO,
Upper Colorado River Commission, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W80-04930

GLOBAL WATER LAW SYSTEMS AND WATER CONTROL,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 6E.
W80-04932

ADMINISTRATIVE WATER RIGHTS INSPECTIONS IN CALIFORNIA,
For primary bibliographic entry see Field 6E.
W80-05000

4B. Groundwater Management

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, NYE COUNTY, NEVADA 1976-77,
Geological Survey, Carson City, NV. Water Resources Div.
R. L. Carson.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $3.24, Microfiche $3.50. Geological Survey open-file report 79-742, 1979. 22 p, 9 Fig, 2 Tab, 7 Ref.

Descriptors: *Basic data collections, *Groundwater resources, *Nevada, *Spring waters, *Water level fluctuations, Irrigation, Pumping, Irrigation wells, *Devils Hole area(Nev), Fish, Endangered species, *Pupfish.

This report presents water data collected in Devils Hole and vicinity from July 1976 through June 1977 for the purpose of observing the effects of irrigation pumping on the pool level in Devils Hole, Nye County, Nevada. The pool contains the endangered species of pupfish, Cyprinodon diabolis. The report presents changes in water level and springflow in graphic form and tabulates electric energy consumed by irrigation wells as an index of the pumpage. (Kosco-USGS)
W80-04853

BOREHOLE GEOPHYSICS IN IGNEOUS AND METAMORPHIC ROCKS,
Geological Survey, Denver, CO. Water Resources Div.
W. S. Keys.
In: Transactions of Twentieth Annual Logging Symposium, Society of Professional Well Log Analysts held in Tulsa, Oklahoma, June 3-6, 1979. 26 p, 21 Fig, 1 Tab, 12 Ref. Society of Professional Well Log Analysts, Houston, Texas.

Descriptors: *Borehole geophysics, *Ingenous rocks, *Metamorphic rocks, *Logging(Recording), Wells, Computer models, Geothermal studies, Exploration, Radioactive wastes, Fractures(Geologic), Thermal water, Borehole cameras, Hydrogeology.

Activities in geothermal energy, radioactive and industrial waste disposal, mineral exploration, engineering geology, and lunar and deep crustal exploration have increased the need for borehole geophysics in igneous and metamorphic rocks. Because there is a lack of knowledge and experience in the application of borehole geophysics to these rocks, the U.S. Geological Survey is conducting research in this area. Igneous and metamorphic rocks usually present different petrophysical properties, such as porosity, density, resistivity, and mineralogy, than do sedimentary rocks. For this reason all conventional geophysical logging techniques may not be useful and petrophysics must be used to develop appropriate methods of log analysis. Core analyses plotted against log response and crossplotting of various logs in the computer are particularly useful for identifying the various rock types in an igenous complex. Hydrothermal alteration and fluid movement through fractures are very important parameters that are needed from logs. Hydrothermal alteration may be recognized on well logs through the use of crossplots and borehole gamma spectrometry. The acoustic televiewer supported by other logs has been highly successful for identifying fractures that are transmitting either hot or cold water. (Kosco-USGS)
W80-04887

GROUNDWATER AUGMENTATION PLANS IN COLORADO,
For primary bibliographic entry see Field 6E.
W80-04928

WATER DISTRICT'S NEEDS ARE MET,
UOP, Inc., St. Paul, MN. Johnson Div.
G. M. Erickson.
The Johnson Drillers Journal, Vol 52, No 1, p 2-3, January-February, 1980. 1 Fig.

Descriptors: *Subsurface investigations, *Drilling, *Ground water resources, *Kentucky, Water wells, Water districts, Rural water, Aquifer testing, Drawdown, Transmissivity, Specific capacity, Well fields, Safe yield, Ohio River, Sand aquifers, Test wells, Groundwater potential, Aquifer management.

The Ohio River-Oldham Water District of northeastern Kentucky engaged the Reynolds Company of Louisville to search for ground water sources near Westport. A good coarse sand and gravel aquifer was located and tested. A 32-inch diameter well was drilled by revere circulation. The well screen and gravel pack were specially designed and constructed to maximize the transmitting capacity to nearly 1500 gpm. Results of the aquifer test indicated a transmissivity of 40,000 to 45,000 gpd per ft and a specific capacity of 19.45 gpm per ft. of drawdown indicating a well efficiency of 85 percent. A test well, drilled closer to the Ohio River indicated that the aquifer became thinner and finer. Three more test wells were drilled in order to fully explore the well field potential. Based on the results of this exploration program, the Ohio River-Oldham Water District now has four completed production wells with safe yields as high as 1.7 mgd and totaling 5.5 mg. (Purdin-NWWA)
W80-05082

THE CASE FOR ARTIFICIAL RECHARGE,
Igrea Group, C.A., Caracas (Venezuela).
J. M. Espina.
The Johnson Drillers Journal, Vol 52, No 1, p 7-11, January-February, 1980. 1 Fig.

Descriptors: *Artificial recharge, *Ground water recharge, Water spreading, Pit recharge, Furrow systems, Injection wells, Induced infiltration, Recharge wells, Aquifers, Clogging, Benefits, Water storage, Conjunctive use, Surface-ground water relationships.

Artificial recharge can be used for waste disposal, secondary oil recovery, land subsidence problems, salt-water intrusion control, and ground water storage. Various methods of artificial recharge include: water spreading, pit recharge, excavations, wells and shafts, and pumping. Water spreading can be done in a basin, a series of ditches or furrows, a natural stream channel, or irrigation canals. Alternating wet and dry periods in a basin results in greater total recharge than continuous spreading. Water spreading is not effective in areas where subsurface strata restrict the downward passage of water or where the cost of land is prohibitive. In these areas recharge can be conducted through injection wells. Recharge rates rarely equal pumping rates due to clogging of the aquifer with silt and bacteria. Induced recharge involves pumping of ground water from a well adjacent to a lake or stream and can result in high-quality water. The tangible and intangible benefits of artificial recharge are outlined along with the physical requirements for appropriate storage, movement and use of recharge water. The major alternative, surface storage, costs more to construct and is subject to evaporation losses and seasonal availability of water. (Purdin-NWWA)
W80-05098

4C. Effects On Water Of Man's Non-Water Activities

THE INFLUENCE OF LAND-USE CHANGE ON WATER RESOURCES,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180904, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Technical Research Report, June 1979. 60 p, 3 Fig, 14 Tab, 9 Ref, Append. OWRT A-040-DEL(6), 14-34-0001-9008.

Descriptors: *Land development, *Effects, *Groundwater, *Water table, Land use, Land clearing, Hydrologic budget, Water balance, Groundwater recharge, Runoff, Overland flow, Streamflow, Climatology.

This report provides detailed examples of the hydrologic consequences of two specific land-use changes. The first involves the effect on streamflow of a gradual change from cultivation to suburbanization in a basin near Wilmington, Delaware, while the second involves the effect on recharge to the water table of introducing a suburban housing development in a formerly agricultural and wooded tract. Both examples make use of information developed from the climatic water budget. In the first example, it is found that the gradual change from forest and cultivation to suburbanization has resulted in a progressive increase in stream runoff averaging about 0.04 inch per year over the past 30 years. In the second example, increasing the amount of impervious surfaces decreases ground water recharge. In order to have no detrimental effect on the water table recharge, detention (by means of some sort of infiltration basins or ponds) of about one-half of the water falling on impervious surfaces in the housing development is necessary in order for the water table recharge after development to equal the recharge before development.
W80-04873

COASTAL LAND USE CONTROL IN SWEDEN,
San Diego Univ., CA. School of Law.
For primary bibliographic entry see Field 6E.
W80-04920

SAVING CALIFORNIA'S COAST: THE COASTAL ZONE INITIATIVE AND ITS AFTERMATH,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04924

THE ROLE OF WATER IN THE HISTORY AND DEVELOPMENT OF COLORADO,
For primary bibliographic entry see Field 6E.
W80-04931

THE PRESSURE FOR SHORELINE DEVELOPMENT: SPATIAL CONCEPTS IN REVIEW,
Ottawa Univ. (Ontario).
For primary bibliographic entry see Field 6E.
W80-04991

PORT AUTHORITIES VIEW STATE COASTAL MANAGEMENT PROGRAMS,
Maine Dept. of Transportation, Portland. Bureau of Waterways.
For primary bibliographic entry see Field 6E.
W80-05094

4D. Watershed Protection

SUSPENDED SEDIMENT FROM FOREST ROAD CONSTRUCTION,
Washington Univ., Seattle. Coll. of Forest Resources.
D. D. Wooldridge, and A. G. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180508, Price codes: A05 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University, Pullman Project Completion Report October 15, 1978, Revised January 1980. 78 p, 14 Fig, 2 Tab, 14 Ref, 1 Append. OWRT A-088-WASH(1).

Descriptors: *Suspended load, *Sediments, *Forest management, *Road construction, Washington, Turbidity, Suspension, Sediment control, Rainfall-runoff relationships, Water sampling, Precipitation(Atmospheric), Erosion, Grading, Roadbanks.

Concentrations and total quantities of suspended sediment in portions of Fly Creek, an undisturbed tributary of the Clearwater River in western

Washington, were studied during the construction of 1.4 miles of unpaved forest road in the watershed. Fly Creek is a Class A, Excellent, stream with a watershed of 649 acres. Approximately 90% of the 140 to 200 inches of annual precipitation becomes streamflow. The road was constructed in accordance with the Best Management Practices defined by the Washington State Forest Practices Rules and Regulations. Sediment concentrations were determined from water samples taken with ISCO automatic samplers that withdraw 500 ml of water at selected intervals. Only visually turbid samples were analyzed and suspended sediment was measured in mg/l. In the laboratory, a Hach model 2100A turbidometer was used to determine the turbidity. Results show that suspended sediment increased both during and after road construction and that sediment concentrations from the construction were related to the proximity of the construction to the stream and the occurrence of rainfall. Sediment increases were small during construction or log hauling during periods without rainfall. Sediment increases were not dependent on work hours or stream discharge. Sediment increases generally occurred on days after construction or hauling was stopped due to rain. A major impact of the road construction was the rapidness with which rainfall causes the suspended sediment increases. (Seigler-IPA)
W80-04808

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

COASTAL WATER POLLUTION AROUND TIBER RIVER MOUTH--A CASE STUDY,
Consiglio Nazionale delle Ricerche, Rome (Italy). Inst. for Water Research.
For primary bibliographic entry see Field 5B.
W80-04840

TECHNIQUES FOR EXPLORING AND PRESENTING DATA APPLIED TO LAKE PHOSPHORUS CONCENTRATION,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 7C.
W80-04843

ANALYSIS OF GROUND WATER BY DIFFERENT LABORATORIES -- A COMPARISON OF CHLORIDE AND NITRATE DATA, NASSAU AND SUFFOLK COUNTIES, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
B. G. Katz, and R. K. Krulikas.
Geological Survey open-file report 79-1063, 1979. 8 p, 2 Fig, 2 Tab, 6 Ref.

Descriptors: *Groundwater, *Analytical techniques, *Laboratory tests, *Water quality, *Water pollution sources, Chlorides, Nitrates, Water wells, Sampling, Statistical analysis, New York, *Nassau County(NY), *Suffolk County(NY).

Water samples from wells in Nassau and Suffolk Counties were analyzed for chloride and nitrate. Two samples were collected at each well; one was analyzed by the U.S. Geological Survey, the other by a laboratory in the county from which the sample was taken. Results were compared statistically by paired-sample t-test to indicate the degree of uniformity among laboratory results. Chloride analyses from one of the three county laboratories differed significantly (0.95 confidence level) from that of a Geological Survey laboratory. For nitrate analyses, a significant difference (0.95 confidence level) was noted between results from two of the three county laboratories and the Geological Survey laboratory. The lack of uniformity among results reported by the participating laboratories indicates a need for continuing participation in a quality-assurance program and exercise of strong quality control from time of sample collection through analysis so that differences can be evaluated. (Kosco-USGS)
W80-04852

APPLICATION OF ENZYME METHODS TO THE DETERMINATION OF POLLUTANTS IN WATER,
Nebraska Univ., Lincoln. Dept. of Food Science and Technology.
K. M. Shahani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181167, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, March 1980. 27 p, 3 Fig, 15 Tab. OWRT A-040-NEB(3), 14-34-0001-5027.

Descriptors: *Enzymes, Whey, Immobilized enzymes, Alcohol, *Pollutants, *Sewage effluents, Streams, Sampling, Biochemical oxygen demand.

Composite sewage samples were collected from a local dairy's effluent stream and analyzed for proximate composition, pH and BOD. Of the total BOD, lactose contributed 60%, protein 25% and lipid 15%. Enzymatic hydrolysis of these components increased the initial rate of utilization by the sewage microflora, but had no significant effect on the five-day BOD. The enzymes lactase, papain and lipase were immobilized either singly or together on a derivitized Sepharose solid support and used for the hydrolysis of lactose, protein and lipid in whey. Immobilization increased the stability of the enzymes without significantly altering their activity, pH optimum, temperature optimum or kinetic parameters. This multi-enzyme immobilized system offers promise for preparation of a hydrolyzed whey product. Proteins were recovered by precipitation with salt or heat or by ultrafiltration and the resultant permeate subjected to further reclamation. An immogilized lactase system was used for the continuous hydrolysis of the lactose in the permeate. The hydrolyzed product was quite sweet and could be used as a food grade syrup. The lactose in the whey permeate was converted to alcohol by the yeast Kluyveromyces fragilis. The permeate was used alone or in combination with grain to produce industrial alcohol for use in gasohol. Substitution of the whey for part of the grain mash water added additional fermentable carbohydrate and allowed a 15% reduction in grain with no decrease in alcohol production.
W80-04868

THE USE OF THE WATER BUDGET IN EVALUATING LEACHING THROUGH SOLID WASTE LANDFILLS,
Delaware Univ., Newark. Dept. of Geography.
For primary bibliographic entry see Field 5B.
W80-04875

WATER ANALYSIS IN SOUTH AFRICA: INTERLABORATORY COMPARISON STUDIES. PART VI: BORON, SILICON, MBAS, CYANIDE, PHENOL, SULPHIDE, BOD, COLOUR AND TURBIDITY, ANALYSES,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Water S. A., Vol 6, No 1, p 31-36, January 1980. 4 Tab, 13 Ref.

Descriptors: *Water quality, *Laboratory tests, *Water analysis, *Analytical techniques, Turbidity, Boron, Silica, Phenols, Sulfides, Biochemical oxygen demand, Statistical methods, Laboratory equipment, Color, Standards, Instrumentation, Reliability, South Africa.

Synthetic water samples were analyzed in 14 South African laboratories for interlaboratory comparison of results on nine water quality parameters. The parameters were boron, silicon, methylene blue active substances (MBAS), cyanide, phenol, sulfide, biochemical oxygen demand (BOD), color, and turbidity. Laboratories were allowed complete freedom of choice in the selection of analytical procedures used. Laboratories were supplied with 250 cu cm samples and were assigned code numbers known only to that laboratory and to the study originator. Not all laboratories tested for all parameters. Collected results were reviewed for outliers using the ASTM procedure and were then analyzed for mean, mean error, relative mean error, standard deviation, and coefficient of variation. Using statistical procedures 80% of the results were found to be acceptable, 20% acceptable but questioned, and no results were unacceptable. Brief descriptions are given for each parameter including how many laboratories tested for it, methods used, and equipment used. Recognized standard methods or slight modifications were generally used and overall satisfactory results were obtained. The relative reliability of analytical methods for cyanide, phenol, sulfide, and BOD could not be determined due to insufficient results. For MBAS determination is recommended that linear alkylate sulfonate be used as the standard reference material. For turbidity determination the use of the Hach Turbidimeter Model 2100 or 2100A is recommended. (Seigler-IPA)
W80-04885

WATER ANALYSIS IN SOUTH AFRICA: INTERLABORATORY COMPARISON STUDIES. PART VII: CONCLUSIONS,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Water S. A., Vol 6, No 1, p 37-40, January 1980. 2 Tab, 11 Ref.

Descriptors: *Water quality, *Laboratory tests, *Water analysis, *Analytical techniques, Statistical methods, Laboratory equipment, Standards, Instrumentation, Reliability, Water pollution, Testing procedures, Evaluation.

Interlaboratory comparison studies involving the analysis of synthetic water samples by 18 laboratories in South Africa were conducted from 1976 through 1978. In all 48 water quality parameters were assessed although all parameters were not analyzed in all laboratories. The specific parameters and the number of laboratories participating are given. Results from each laboratory were statistically assessed and compared to develop a comprehensive picture of the state of water analysis in South Africa. The testing laboratories used a wide variety of both standard and non-standard methods. Due to this variety it is recommended that a recognized set of standard methods for water and waste water analysis be developed. Overall results were good and all laboratories participating would qualify for certification in the Oklahoma laboratory certification program. Specific findings and recommendations include: (1) pH and alkalinity should be determined immediately after opening the sample container; (2) specific conductance determinations should be carried out at 25C; (3) for total alkalinity determination potentiometric titration should be used for more accurate results; (4) for arsenic and selenium determinations by atomic absorption, sodium borohydride should be used as the hydride generant; and (5) for turbidity a Hach Turbidimeter Model 2100 or 2100A should be used. Participating laboratories are listed. (Seigler-IPA)
W80-04886

TEMPERATURE AND ADAPTATION TO POLLUTION AS FACTORS INFLUENCING THE ACUTE TOXICITY OF CD TO THE PLANKTONIC COPEPOD ACARTIA CLAUSI,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, G. Verriopoulos, and P. Palla.
Tethys, Vol 9, No 2, p 97-101, 1979. 1 Fig, 2 Tab, 29 Ref.

Descriptors: *Bioassay, *Cadmium, *Copepods, Water temperature, Adaptation, Lethal limit, Toxicity, Mortality, Zooplankton, Bioindicators, Heavy metals, *Acartia.

Static acute toxicity bioassays were conducted with Cd Cl2,2H20 using adult females of the planktonic Copepod A. clausi. The experiments were run at two temperatures: 14 + or - 0,5C and 22 +

or - 0,5C on natural Copepods assemblages from two different locations: one from an area polluted with industrial effluents and domestic wastes and another one from a relatively clean area. Results of cadmium toxicity tests, expressed as LC 50 48 hours, indicate a significant difference in the tolerance to cadmium between the two populations. Furthermore, for both populations the increase in temperature from 14 to 22C resulted in a two fold increase in the sensitivity of Acartia to cadmium. (Deal-EIS)
W80-04891

FIRST RECORD OF A BLOOM OF GONYAULAX MONILATA IN COASTAL WATERS OF MISSISSIPPI,
Gulf Coast Research Lab., Ocean Springs, MS.
H. M. Perry, K. C. Stuck, and H. D. Howse.
Gulf Research Reports, Vol 6, No 3, p 313-316, 1979. 3 Fig, 10 Ref.

Descriptors: *Dinoflagellates, *Red Tide, *Gulf of Mexico, Mississippi, Marine algae, Coastal waters, Growth rates, Water temperature, Salinity, Nuisance algae, Cytological studies, Florida, Alabama, Louisiana, *Gonyaulax, Public health.

Data are presented on a bloom of the toxic dinoflagellate Gonyaulax monilata in coastal waters of Florida, Alabama, Mississippi and Louisiana. The initial outbreak of the G. monilata bloom followed a period of lowered salinities in Mississippi Sound due to heavy rains associated with Hurricane Bob (11 July) and Tropical Storm Claudette (23 July). Surface temperatures and salinities during the bloom ranged from 30.0 to 30.8C and 24.0 to 26.0 ppt, respectively. Extensive blooms of G. monilata occurred in Florida and Alabama concurrent with the Mississippi outbreak. This is the first record of a bloom of this species in Mississippi and adjacent Gulf of Mexico. (Deal-EIS)
W80-04892

EFFECTS ON FISH EXPOSED TO EFFLUENT FROM A TITANIUM DIOXIDE INDUSTRY AND TESTED WITH ROTATORY-FLOW TECHNIQUE,
Institutet for Vatten- Och Luftvardsforskning, Stockholm (Sweden).
K-J. Lehtinen.
Ambio, Vol 9, No 1, p 31-33, 1980. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Toxicity, *Fish behavior, *Metals, Chemical wastes, Industrial wastes, Perches, Analytical techniques, Methodology, Fish physiology, Animal metabolism, Animal pathology, Mode of action, *Titanium, *Bleak, *Alburnus, Titanium dioxide industry.

It has become evident that such traditional field methods as calculations of species diversity and determinations of biomass in a polluted area are insufficient when the ecological effects of pollutants are to be determined. For this, a method which will detect some physiological malfunction is needed as a complement to traditional field methods. This paper deals with the performance of fish exposed to effluent from a titanium-dioxide industry. A total of 120 fish of two different species were exposed for 14 and 28 days to various concentrations of the effluent and then tested by means of the 'rotary-flow' technique. They displayed a statistically significant decrease in ability to compensate for torque in the rotating current. This is considered to indicate neuromuscular dysfunction and/or other physiological impairment. The most visible effect of the effluent was a brown precipitate on the gills. Fish from the area affected by the factory discharge are known to have a similar precipitate on the gill epithelium. (Deal-EIS)
W80-04906

A ROUTINE WATER MONITORING TEST FOR MUTAGENIC COMPOUNDS,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
J. B. Johnston, and J. N. Herron.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181761, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report 141, May 1979, 94 p. S-057-ILL.

Descriptors: *Mutagens, *Ames assay, *Parfait/distillation method, Potable water, *Surface waters, Water analysis, Chemical analysis, Mutagenic chemicals, Water pollution, Public health, *Carcionogens.

The development of a simple, relatively comprehensive method for the recovery of nonvolatile mutagenic compounds from surface waters is described. The method recovers compounds by sequential passage of the water sample through a silica gel bed, then a cation-exchange bed, and then an anion-exchange bed - all contained in a single multi-bed column of glass and teflon, the parfait column. Nonvolatile compounds not adsorbed to any of these beds were recovered following concentration of the column effluent by vacuum distillation at < 30 degrees. The beds of the parfait column were separated and eluted independently. Using the Ames Salmonella/microsome reversion assay, each residue was assayed for mutagenic activity. The method was evaluated by recovery of five known mutagens, benzo(a)pyrene, 4-nitroquinoline-1-oxide, ethidium bromide, nitrofurylfuramide, and solium azide, each initially spiked into a sample of laboratory deionized water and an environmental water sample to a final concentration of less than 3ppb. The method has been used to survey ten Illinois surface waters for naturally occurring mutagenic activity. The parfait/distillation method differs from other techniques for the recovery of waterborne mutagens in its emphasis on the recovery of nonvolatile compounds and neutral water-soluble compounds. This method has also detected a significant mutagenic activity in samples as small as 2 gallons of water, a volume consumed by a normal person every few days.
W80-04937

HIGH FREQUENCY TEMPERATURE FLUCTUATIONS IN A POWER-PLANT THERMAL PLUME,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W80-05009

THE ACID-BASE BALANCE IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 2H.
W80-05016

FRESHWATER PHYTOPLANKTON FROM THE NARSSAQ AREA, SOUTH GREENLAND,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
For primary bibliographic entry see Field 2H.
W80-05018

SHORT-TERM RESPONSES OF NUTRIENT-DEFICIENT ALGAE TO NUTRIENT ADDITION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
F. P. Healey.
Journal of Phycology, Vol 15, No 3, p 289-299, September 1979. 8 Fig, 3 Tab, 61 Ref.

Descriptors: *Scenedesmus, *Photosynthesis, *Respiration, *Metabolism, *Analytical techniques, *Nutrient requirements, *Limiting factors, Chlorophyta, Kinetics, Phosphorus, Nitrogen, Nutrients bioassay, Ammonium compounds, Phosphates, Cultures, Laboratory tests, Population dynamics, Population, Growth rates, Plant physiology, Cytological studies, Algae.

Experiments studying phosphate of ammonium additions to green alga Scenedesmus quadricauda cultures deficient in phosphorus (P) or nitrogen (N), show that photosynthetic responses cannot reliably be used in short-term enrichments, rather changes in dark respiration or ATP are useful. Enrichment experiments involving small water volumes and population growth do not measure real but only potential nutrient limitations after other limiting factors, natural loading and regeneration have been removed. Experiments suffer from changing species composition and declining growth rates. To determine nutrient deficiencies actually present in a population, physiological indicators need to be measured. Photosynthetic responses are not appropriate. On the basis of experiment results, changes in dark respiration or ATP content are appropriate responses in some situations. The present results are confined to growth of Scenedesmus quadricuada the first eight h following addition and therefore indicate only possible solutions. The deficient nutrient is rapidly taken up. Light-saturated net photosynthesis is depressed below pre-addition rates during nutrient uptake and does not increase until several hours after uptake is complete. Dark respiration, on the other hand, is markedly stimulated during nutrient uptake and to a lesser extent after uptake is complete. Phosphate addition to P-deficient cells cause large increases in ATP content within 2-4 h of addition, whereas ammonium addition to N-deficient cells causes much less or no increase in ATP content. (Danovich-Wisconsin)
W80-05022

DISTRIBUTION AND ABUNDANCE OF LOW MOLECULAR WEIGHT HYDROCARBONS AND SUSPENDED HYDROCARBONS IN COOK INLET, ALASKA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Cline, C. Katz, and A. Young.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 264-325, October 1979. 28 Fig, 2 Tab, 40 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Aromatic compounds, *Toxicity, *Natural gas, *Pollutant identification, Water pollution effects, Resources development, Environmental effects, Baseline studies, Oil pollution, Alaska, *Outer Continental Shelf, Cook Inlet, Crude oil, Hydrocarbons, Anthropogenic sources, Petroleum development, Toxicants.

During the past two years, emphasis has shifted toward sources of low molecular weight (LMW) hydrocarbons in Cook Inlet, including both natural and anthropogenic sources. Special attention has been devoted to sources of LMW aromatics in upper Cook Inlet and the fate of these compounds. Specialized studies in Cook Inlet have continued on the air-sea exchange of LMWH and in-situ production of gases in both the water column and from the underlying sediments. These data provide necessary information for the identification and sources of petroleum-like hydrocarbons in the waters of Cook Inlet. These studies were enacted to characterize the dissolved LMW natural hydrocarbons in Cook Inlet, Alaska. The purpose was to establish concentration levels and temporal and spatial variability of hydrocarbon components common to petroleum or natural gas resources prior to actual production. These measurements were felt to be an invaluable precursor to future monitoring efforts. The principal concern surrounding the distributions, sources, and sinks of LMWH is not their direct impact on biota, but rather their role as tracers of more toxic hydrocarbon fractions commonly found in crude oils. The principal goal is to provide the criteria for an early warning detection of petroleum-derived hydrocarbons and to establish the feasibility of using light hydrocarbons as tracers, particularly in reference to near-bottom mixing and resuspension processes. (Sinha-OEIS)
W80-05062

5B. Sources Of Pollution

TRACE METALS IN SUSPENDED PARTICULATES, BIOTA, AND SEDIMENTS OF THE ST.

CROIX, NARRAGUAGUS, AND UNION ESTUARIES AND THE GOOSE COVE REGION OF PENOBSCOT BAY,
Maine Univ. at Orono. Dept. of Oceanography.
L. K. Fink, A. B. Harris, and L. L. Schick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181456, Price codes: A05 in paper copy, A01 in microfiche.
Maine Land and Water Resources Center Maine University Completion Report. April 1980. 296 p, 177 Fig, 22 Tab, 32 Ref. OWRT A-041-ME(1) and B-015-ME(1).

Descriptors: *Maine, *Estuaries, *Heavy metals, *Water pollution sources, Water quality, Sediments, Suspended solids, Biota, Agricultural runoff, Mining, Industrial wastes, Sewage effluents, Spectrophotometry, Watersheds(Basins), Brackish water.

Samples from four Maine estuaries were analyzed to determine the concentrations, distributions, and sources of heavy metals (Ag, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, and Zn) in their suspended particulates, sediments, and biota. The four estuaries studied and their dominant impacting anthropogenic activity are: the St. Croix River, pulp and paper processing; the Narraguagus River, agricultural activity; the Union River, untreated town sewage; and Goose Cove (Penobscot River), mining activity. Sampling sites for each estuary were located both above and below the principal pollution injection sources. Particulate matter samples were taken at both near-surface and near-bottom stations. Animal and plant samples were collected intertidally and as many species as possible were taken at each site. Sediment cores were taken at each site using either standard piston coring or hand coring. A Jarrell-Ash 810 Atomic Absorption Spectrophotometer was used for all analyses. For both the Narraguagus and Union Rivers no significant heavy metal concentration increases were found as a result of the anthropogenic activities in their watersheds. However, increased concentrations of metals were found for the St. Croix River and Goose Cove. Overall results show that long-term compartments such as sediments and especially the fine fraction of sediments are most likely to contain elevated levels of metals while short-term compartments such as biota and suspended particulates are less likely to contain the higher levels. (Seigler-IPA)
W80-04809

SOME LIMITATIONS OF WATER QUALITY MODELS FOR LARGE LAKES: A CASE STUDY OF LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
T. J. Simons, and D. C. L. Lam.
Water Resources Research, Vol 16, No 1, p 105-116, February 1980. 7 Fig, 5 Tab, 19 Ref, 1 Append.

Descriptors: *Water quality, *Lakes, *Lake Ontario, *Model studies, Mathematical models, Nutrients, Sediments, Pollutants, Path of pollutants, Sediment transport, Phosphorus, Water pollution, Water pollution sources, Limnology, Water quality models.

Some of the problems encountered in the design of a predictive water quality model for a large lake were discussed with reference to Lake Ontario and within the framework of a simple dynamic phosphorus model which incorporates the essential mechanisms of complex plankton models. By fitting the model to a seasonal data base it was shown that equally satisfactory simulations are obtained with a variety of parameterizations and regardless of conditions of annual periodicity imposed on the solution. By comparison of model output with long-term observations it was demonstrated that seasonal verification studies of dynamic models by themselves are not sufficient to diagnose the utility of such models for predicting long-term trends. It was concluded that the uncertainty surrounding the formulation of sedimentation and nutrient regeneration, in conjunction with the sensitivity of models to assumptions regarding dynamic balance between lake concentrations and nutrient loadings, undermines the predictive capability of dynamic water quality models. (Sims-ISWS)
W80-04818

DIFFUSION OF A PASSIVE SCALAR WITH RANDOM ADVECTION,
Oak Ridge National Lab., TN.
J. E. Molyneux, and A. J. Witten.
Water Resources Research, Vol 16, No 1, p 137-144, February 1980. 4 Fig, 9 Ref, 1 Append.

Descriptors: *Diffusion, *Streamflow, *Pollutants, *Path of pollutants, *Model studies, Mathematical models, Probability, Statistics, Stochastic processes, Mass transfer, Streams, Rivers, Flow, Mixing, Water pollution.

To investigate the instantaneous release of a passive additive into a flow, it was assumed that the concentration of the additive is governed by the one-dimensional advective diffusion equation in which the advecting flow velocity is a given time-dependent stochastic process. Both the one- and two-space-time point probability distributions of the random concentration field were determined. This problem, or more elaborate variations of it, is a rather idealized model for a variety of environmentally important flow situations, for example, the accidental or planned release of a contaminant into a river by a power station, and, as such, it has been investigated by a number of authors. Previous treatments, however, have concentrated on deriving information about the statistical moments of the concentration. Although such information is important, it may be inadequate for accessing the true effects of a flow additive on the environment. This investigation demonstrated the possibility of obtaining a more complete statistical description. (Sims-ISWS)
W80-04821

INTERVENTION ANALYSIS WITH MISSING DATA,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-04823

DISPERSION IN TWO-LAYER STRATIFIED WATER BODIES,
National Technical Univ., Athens (Greece). Applied Hydraulics Lab.
For primary bibliographic entry see Field 2L.
W80-04833

COASTAL WATER POLLUTION AROUND TIBER RIVER MOUTH--A CASE STUDY,
Consiglio Nazionale delle Ricerche, Rome (Italy). Inst. for Water Research.
T. La Noce, R. Pagnotta, M. Pettine, and A. Puddu.
Progress in Water Technology, Vol 12, No 1, p 193-209, 1980. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Water pollution, *Coasts, *Rivers, *Water pollution sources, Pollutants, Pollutant identification, On-site investigations, Sampling, Heavy metals, Toxins, Eutrophication, Nutrients, Salinity, Temperature, Dissolved oxygen, Chemical oxygen demand, Biochemical oxygen demand, Benthos, Benthic fauna, *Italy, *Tiber River(Italy).

The need to evaluate the impact of the Tiber River on the receiving marine ecosystem, and the extent of pollution abatement required to safeguard the various coastal water uses, promoted an interdisciplinary experimental investigation. First stage results of the investigation carried out off the river mouth were presented. The extension of the area influenced by the river has been estimated at 400 sq km. Due to the river's high nutrient input rates, eutrophic processes occur with an intensity depending on sample distances from the mouth. Some data concerning the limiting factor were also derived. Toxicity studies revealed an incipient threat from Cd and Hg concentration. HCB was only occasionally found in the zone; PCB's were found in surprisingly high levels further away from the river mouth. Bacteriological data led to the conclusion that the river's impact on beach bathing conditions is only limited to an area immediately adjacent to the two outfalls. With the exception of minor changes due to the eurhyaline nature of the zone, no major variation in receiving area ecology was detected (for benthos and nekton). (Sims-ISWS)
W80-04840

THE DETERMINATION OF EDDY DIFFUSION COEFFICIENTS USING NATURAL TRACERS,
Watson (Dagh) S.p.A, Milano (Italy).
A. Denegri, and F. Martini.
Progress in Water Technology, Vol 12, No 1, p 339-344, 1980.

Descriptors: *Dispersion, *Diffusion, *Sewage, *Outfall sewers, Model studies, Mathematical models, Tracers, Salinity, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Coasts, Equations, Mathematics, *Sicily, *Messina(Sicily), *Straits of Messina.

The paper described the development of equations for the calculation of coefficients of eddy diffusion using salinity as a tracer. The results were reported of experimental work carried out in the Straits of Messina to calculate the dispersion of sewage from two proposed outfalls from the City of Messina. The authors concluded that the use of salinity as a tracer has significant advantages over the use of an artificial tracer. In particular this is because the system concerned very closely approximates to the steady state it is assumed to be, unlike that which develops using artificial tracers. Furthermore, the instrumentation involved is simple and of low cost, and the extent of the survey area is much reduced. In the areas studied the variation in salinity was sufficient to enable satisfactory calculation of the diffusion coefficients. (Sims-ISWS)
W80-04841

CHEMICAL AND SEDIMENT MASS TRANSFER IN THE GODAVARI RIVER BASIN IN INDIA,
Jawaharlal Nehru Univ. New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W80-04845

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR SILVER CREEK, CLARK AND FLOYD COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. G. Wilber, C. G. Crawford, and J. G. Peters.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $8.50, Microfiche $3.50. Geological Survey open-file report 79-1253, July 1979. 60 p, 22 Fig, 10 Tab, 47 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Effluents, Forecasting, Water quality standards, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, Mathematical models, *Clark County(Ind), *Floyd County(Ind), *Silver Creek(Ind).

The Indiana State Board of Health is developing a State water-quality management plan that includes establishing limits for wastewater effluents discharged into Indiana streams. A digital model calibrated to conditions in Silver Creek was used to develop alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. Effluents from the Sellersburg and Clarksville-North wastewater-treatment facilities are the only point-source waste loads that significantly affect the water quality in the modeled segment of Silver Creek. Model simulations indicate that nitrification is the most significant factor affecting the dissolved-oxygen concentration in Silver Creek during summer and winter low flows. Natural streamflow in Silver Creek during the summer and

annual 7-day, 10-year low flow is zero, so no benefit from dilution is provided. Present ammonia-nitrogen and dissolved-oxygen concentrations of effluent from the Sellersburg and Clarksville-North wastewater-treatment facilities will violate current Indiana water-quality standards for ammonia toxicity and dissolved oxygen during summer and winter low flows. The current biochemical-oxygen demand limits for the Sellersburg and Clarksville-North wastewater-treatment facilities are not sufficient to maintain an average dissolved-oxygen concentration of at least 5 milligrams per liter, the State's water-quality standard for streams. Calculations of the stream's assimilative capacity indicate that Silver Creek cannot assimilate additional waste loadings and meet current Indiana water-quality standards. (Kosco-USGS)
W80-04861

ARSENIC, NITRATE, IRON, AND HARDNESS IN GROUND WATER, CHENA RIDGE VICINITY, FAIRBANKS AREA, ALASKA,
Geological Survey, Fairbanks, AK. Water Resources Div.
A. P. Krumhardt.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO., paper copy $3.50, microfiche $1.00. Geological Survey open-file report 80-49, 1979. 1 Sheet, 9 Ref.

Descriptors: *Water quality, *Groundwater, *Water wells, *Iron, *Hardness(Water), Water analysis, Chemical analysis, Water pollution, Public health, Maps, Alaska, *Fairbanks(Alaska).

The report presents all data on hardness, iron, nitrate and arsenic in well water in the Chena Ridge area of Fairbanks, Alaska, through June 1979. Concentrations range as follows: arsenic - 0 to 28 micrograms per liter; nitrate - 0 to 20 milligrams per liter; iron - 0 to 18 milligrams per liter and hardness - 72 to 1,400 milligrams per liter. Values at the upper ends of the ranges for iron and nitrate exceed limits recommended by the Environmental Protection Agency for public water supplies. A map of the area showing the location of sampled wells and a table of chemical analysis are included. (Kosco-USGS)
W80-04862

THE USE OF THE WATER BUDGET IN EVALUATING LEACHING THROUGH SOLID WASTE LANDFILLS,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather, and P. A. Rodriguez.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180888, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Report, October 1978, 39 p, 3 Fig, 4 Tab, 10 Ref, 3 Append. OWRT A-040-DEL(3), 14-34-0001-9008.

Descriptors: *Hydrologic budget, *Landfills, *Leaching, *Solid wastes, Subsurface drainage, Pollutants, Groundwater movement, Path of pollutants, Model studies, Evaluation.

Determination of the volume of leaching through solid waste landfills is a problem of concern to landfill operators everywhere since such leaching may carry pollutants into the local groundwater. The use of a simple yet practical climatic water budget model to calculate possible leaching volume under different landfill conditions is explained and illustrated. The water budget model only requires information on air temperature and precipitation as input. All necessary tables and formulas for evaluating the water budget model are included.
W80-04875

POLLUTION IN THE GREAT LAKES BASIN FROM LAND USE ACTIVITIES.
International Joint Commission-United States and Canada. Great Lakes Regional Office.
Report to the Governments of the United States and Canada, March 1980. 155 p, 5 Fig, 8 Tab, 5 Append.

Descriptors: *Great Lakes, *Water quality, *Water pollution sources, *Land use, Agricultural runoff, Industrial wastes, Lake Erie, Lake Huron, Lake Michigan, Lake Ontario, Lake Superior, Pesticides, Phosphorus, Eutrophication, Sediments, Silting.

In response to a request from the Governments of Canada and the United States, the International Joint Commission conducted an extensive study of the Great Lakes ecosystem and concluded that the Great Lakes are being polluted from land drainage sources. Areas of intensive agricultural and urban use contribute most heavily to this problem by producing pollutants such as phosphorus, sediments, industrial organic compounds, pesticides, and heavy metals. It is estimated that one third to one half of total phosphorus loads in the lakes are attributable to land use activities. The major source of nonpoints loads was cropland especially in highly erodable areas. Approximately 400 organic compounds were identified in the Great Lakes ecosystem including residual levels of DDT, aldrin-dieldrin and chlordane. Other sources of pollution include the atmosphere, siltation, and the disposal of liquid and solid wastes from industry. It is recommended that a comprehensive, basin-wide long-term management strategy, the 'Ecosystem Approach,' be developed to deal with these pollution problems. The areas having the worse water quality problems, Lakes Erie and Ontario, Saginaw Bay, and southern Lake Huron, should be given highest priority for remedial actions. When site-specific measures are needed, the cost-effectiveness of all remedies should be considered. Other areas of concern for remedial action include funding, legislation, coordination levels, and voluntary programs. Some specific remedial programs are recommended. (Seigler-IPA)
W80-04879

STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--1. THE METHEMOGLOBIN-FORMATION BY THE NITROSO-DERIVATIVES IN WHITE-SPOTTED CHAR, SALVELINUS LEUCOMAENIS, ERYTHROCYTES,
Hokkaido Univ., Hakodate (Japan). Lab. of Food Hygiene.
M. Miyauchi, M. Takagi, and T. Uematsu.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 12, p 1563-1567, 1979. 6 Fig, 19 Ref.

Descriptors: *Pesticide toxicity, *Herbicides, *Animal metabolism, Pesticide kinetics, Chemical reactions, Chemical properties, Enzymes, Biochemistry, Fish physiology, Mode of Action, Biphenyl ether herbicides, *Char, *Salvelinus, *Erythrocytes, *Methemoglobin, *Blood chemistry, *Tissue analysis.

The methemoglobin formation by the nitroso-derivatives of biphenyl ether herbicides (2,4-dichloro p-nitrobiphenyl ether and 2,4,6-trichloro p-nitrobephenyl ether) and their analogues was investigated in suspensions of white-spotted char erythrocytes. All of the nitroso-derivatives used, induced the methemoglobin formation among the nitroso-derivatives was the most potent in nitrosobenzene followed by p-nitrosobiphenyl ether, 4-chloro p-nitrosobiphenyl ether, 2,4-dichloro p-nitrosobiphenyl ether and then 2,4,6-trichloro p-nitrosobiphenyl ether in erythrocytes of both species. This order among the nitroso-derivatives was dependent on the number of chlorine rather than on its position of substitution in the phenoxy group. The mechanism of methemoglobin formation by the nitroso-derivatives was similar in erythrocytes of both species and on the requirement of NADPH-dependent enzyme systems, and that of methemoglobin reduction was similar, too, on reception of NADH-dependent enzymatic process. (See also W80-04890) (Deal-EIS)
W80-04889

STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--II. PRODUCTION OF METHEMOGLOBIN-FORMING METABOLITES OF THE AMINO-DERIVATIVES BY WHITE-SPOTTED CHAR, SALVELINUS LEUCOMAENIS, LIVER HOMOGENATE,
Hokkaido Univ., Hakodate (Japan). Lab. of Food Hygiene.
M. Miyauchi, M. Takagi, and T. Uematsu.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 12, p 1569-1573, 1979. 5 Fig, 21 Ref.

Descriptors: *Herbicides, *Pesticide toxicity, *Animal metabolism, Fish physiology, Pesticide kinetics, Biochemistry, Path of pollutants, Chemical reactions, Chemical properties, Enzymes, Biphenyl ether herbicides, *Char, *Salvelinus, *Tissue analysis, *Biotransformation, *Erythrocytes, *Methemoglobin, *Blood chemistry, 2,4-dichloro p-nitrobiphenyl ether, 2,4,6-trichloro p-nitrobiphenyl ether.

The activities of liver homogenates from white-spotted char and rat, to metabolize the amino-derivatives of biphenyl ether herbicides (2,4-dichloro p-nitrobiphenyl ether and 2,4,6-trichloro p-nitrobiphenyl ether) and their analogues to methemoglobin-forming metabolites were compared by incubating liver homogenates with the amino-derivatives, a NADPH-generating system and white-spotted char, rat or human erythrocytes. The results indicated that white-spotted char liver homogenates had the ability to metabolize p-aminobiphenyl ether to methemoglobin-forming metabolites although the activity was very low; while rat liver homogenates had the ability to metabolize all the amino-derivatives to methemoglobin-forming metabolites and the rates of methemoglobin formation among the amino-derivatives were the highest in p-aminobiphenyl ether followed by 4-chloro p-aminobiphenyl ether, 2,4-dichloro p-aminobiphenyl ether and then 2,4,6-trichloro p-aminobiphenyl ether. The sensitivity of erythrocytes to the methemoglobin-forming metabolites were the highest in human followed by rat and then white-spotted char erythrocytes. (See also W80-04889) (Deal-EIS)
W80-04890

TEMPERATURE AND ADAPTATION TO POLLUTION AS FACTORS INFLUENCING THE ACUTE TOXICITY OF CD TO THE PLANKTONIC COPEPOD ACARTIA CLAUSI,
Athens Univ. (Greece). Zoological Lab. and Museum.
For primary bibliographic entry see Field 5A.
W80-04891

CADMIUM, ZINC AND COPPER ACCUMULATION IN LIMPETS (PATELLA VULGATA) FROM THE BRISTOL CHANNEL WITH SPECIAL REFERENCE TO METALLOTHIONEINS,
Liege Univ. (Belgium). Lab. d'Oceanography.
F. Noel-Lambot, J. M. Bouquegneau, F. Frankenne, and A. Disteche.
Marine Ecology--Progress Series, Vol 2, p 81-89, 1980. 8 Fig, 4 Tab, 45 Ref.

Descriptors: *Cadmium, *Absorption, *Invertebrates, Zinc, Copper, Animal metabolism, Animal physiology, Heavy metals, Mode of Action, Path of pollutants, Mollusks, Bristol Channel, England, *Metallothioneins, *Limpets, *Patella, *Bioaccumulation, *Tissue analysis.

The study of metal concentrations in Patella vulgata caught from a polluted environment reveals a direct relationship between Cd concentration and body size and an inverse relationship in regard to Zn and Cu. Most of the Cd present in limpets with heavy Cd loads is bound to thioneins, but this is not the case for Zn and Cu. In young limpets, Cd-thioneins were not detected. All results indicate that during long-term Cd intoxication under field conditions, Cd deposition and increase in metallothioneins in limpets were directly linked. The induced production of metallothioneins may thus be considered as the main mechanism responsible for the cumulative absorption of Cd in limpets living in the Bristol Channel. Isolation and characterization of limpet metallothioneins were performed. They indicate that mollusc metallothioneins are very similar to those from vertebrates. (Deal-EIS)
W80-04893

RELATIONSHIP BETWEEN THE BODY SIZE OF PRINCIPAL SHELLFISH AND THE CONCENTRATION OF FEW HEAVY METALS (IN JAPANESE),
Iwate Prefectural Office (Japan). Forestry and Fishery Div.
S. Kamimura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 1, p 79-82, 1980. 4 Fig, 2 Ref. (English summary).

Descriptors: *Heavy metals, *Absorption, *Commercial shellfish, Bioindicators, Mathematical models, Oysters, Path of pollutants, Animal metabolism, Animal physiology, Weight, Mercury, Copper, Zinc, Cadmium, *Scallops, *Abalones, *Bioaccumulation, *Tissue analysis.

It is important to clarify the concentration of heavy metals in aquatic organisms under normal conditions in order to evaluate heavy metal pollution. For this purpose the normal levels of a few heavy metals in the cultured scallops, oysters and abalones were determined from the relationship between the body weight and the concentration of heavy metals. The results obtained showed that the concentration of each heavy metal in the soft parts increased with the increase of body weight. The relationship was especially significant in the mid-gut gland including stomach of scallops. These results suggest the existence of a characteristic pattern of heavy metal accumulation for each species. The pattern observed in the mid-gut gland of scallops together with that in the soft parts may be available as a biological index for the evaluation of heavy metal pollution in environmental sea water. (Deal-EIS)
W80-04894

CONCENTRATION AND DISTRIBUTION OF URANIUM IN MYTILUS EDULIS AND ASSOCIATED MATERIALS,
Institute for Marine Environmental Research, Plymouth (England).
E. I. Hamilton.
Marine Ecology--Progress Series, Vol 2, p 61-73, 1980. 6 Fig, 8 Tab, 24 Ref.

Descriptors: *Uranium radioisotopes, *Mussels, *Absorption, Path of pollutants, Radioactive wastes, Radioecology, Animal metabolism, Radiochemical analysis, Biochemistry, Seasonal, Bottom sediments, *Tissue analysis, *Bioaccumulation, *Mytilus, *Depuration, *Transuranic elements.

Concentration and distribution of uranium in the mussel Mytilus edulis are described for sampling sites in the United Kingdom near and distant from sources of nuclear effluents; the data reflect natural availability from the marine environment, any effect attributable to the proximity of nuclear effluent discharges being minimal. With the exception of uranium associated with food and particulate materials present in the digestive organ, the highest levels were found associated with byssal threads, the periostracum and the excretory organs. It has been observed that the tanning process associated with the development of byssal threads involves uranium which has a special affinity for SS-SH and disulphide groups in organs. The lowest concentrations of uranium were found in the periostracum-free shell. Depuration experiments have demonstrated that after a fairly rapid loss of uranium from the digestive gland, that which remains within organs and tissues is retained and is associated with the surfaces of organs and tissues. In the sediments uranium is enriched in the finer fraction but no evidence for an excessive enrichment arising from nuclear effluents was observed. (Deal-EIS)
W80-04895

ACCUMULATION AND BIOLOGICAL EFFECTS OF CADMIUM IN RAINBOW TROUT,
Tokai Regional Fisheries Research Lab, Yokosuka (Japan). Arasaki Marine Biological Station.
H. Kumada, S. Kimura, and M. Yokote.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 1, p 97-103, 1980. 2 Fig, 6 Tab, 25 Ref.

Descriptors: *Cadmium, *Absorption, *Rainbow trout, Heavy metals, Fry, Mode of Action, Path of pollutants, Water chemistry, Fish physiology, Bioassay, Growth rates, Mortality, *Bioaccumulation, *Tissue analysis.

The biological effects and accumulation of cadmium stearate, acetate, and chloride in rainbow trout fingerlings were investigated. No adverse effect was observed on survival, growth and histology of the fish exposed to cadmium compounds via water at a concentration of 4 microg Cd/l for 10 weeks, and also the fish exposed to the same compounds via food at a concentration of 10 mgCd/kg for 12 weeks. However, the fish orally exposed to cadmium stearate of 100 mgCd/kg showed histological changes of a slight degree in their livers and kidneys. Total cadmium loads (microg Cd/fish) decreased prominently in the fish orally exposed to the chemicals 10 weeks after discontinuation of exposure, while those in the fish exposed via ambient water almost remained unchanged during this time. From the results of the present study, it is postulated that the route of cadmium absorption via water chiefly participates in the accumulation of the metal in fishes under natural conditions. (Deal-EIS)
W80-04896

INFLUENCE OF COPPER AND ZINC IN FOOD SUBSTANCE ON THE ACCUMULATION OF CULTURED OYSTERS (IN JAPANESE),
Iwate Prefectural Office (Japan). Forestry and Fishery Div.
S. Kamimura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 1, p 83-85, 1980. 1 Fig, 3 Tab, 7 Ref, (English abstract).

Descriptors: *Oysters, *Copper, *Zinc, *Absorption, Aquiculture, Growth rates, Commercial shellfish, Path of pollutants, Heavy metals, Chemical analysis, Water chemistry, Diatoms, *Bioaccumulation, *Tissue analysis.

Living feeds collected at each hanging depth of oyster clumps in sea water of an oyster farm were analyzed for the determination of copper and zinc. The concentration of copper and zinc in oysters cultured at Miyako Bay showed a tendency to decrease according to the hanging depth of oyster clumps, while that in the sea water inversely. The same tendency was also observed in the weight of soft parts of oysters. These results suggest that the growth pattern of cultured oysters, together with the heavy metal accumulation in food substances for oysters, is the principle factor in the characteristics of heavy metal accumulation at each oyster hanging depth. (Deal-EIS)
W80-04897

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: CHEMICAL SPECIATION AND BIOLOGICAL AVAILABILITY OF COPPER IN LAKE WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
P. Baccini, and U. Suter.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 291-314, 1979. 13 Fig, 6 Tab, 26 Ref.

Descriptors: *Copper, *Lakes, *Chemical reactions, Chemical properties, Water chemistry, Sorption, Biomass, Plankton, Hydrogen ion concentration, Heavy metals, Chemical analysis, Seasonal, Copper compounds, *Bioavailability, *Ligands.

The chemical speciation of dissolved copper was investigated in waters from the limno-corrals of the MELIMEX project and compared with speciation data from other Swiss lakes. Copper is complexed primarily by organic ligands having molecular sizes between 10000 and 1000 daltons. The mean concentration of the ligands is approximately 5 x 10 to the minus 7th power mole/mg DOC. The conditional stability constants (pH = 8.8) are about 10 to the 11th power. An increased metal load did not induce an increase of binding ligands. A comparison of calculated Cu2+ concentration with corresponding copper contents in the biomass leads to the conclusion that organic ligands and pH are the most important factors in deciding the biological availability of copper. However, the sorption capacity of the biomass depends as well on the variety of plankton species. (Deal-EIS)
W80-04899

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: BEHAVIOUR OF HEAVY METALS IN AN AQUATIC FOOD CHAIN,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
R. Gachter, and W. Geiger.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 277-290, 1979. 3 Fig, 5 Tab, 30 Ref.

Descriptors: *Food chains, *Heavy metals, *Plankton, Phytoplankton, Zooplankton, Periphyton, Diptera, Lake Trout, Fry, Mercury, Copper, Cadmium, Zinc, Lead, Path of pollutants, Trophic level, Absorption, Sorption, Metabolism, Aquatic insects, *Bioaccumulation, *Tissue analysis.

Phytoplankton, periphyton and zooplankton samples, chironomid and Sialis sp. larvae, and fry of trout and bream collected from unpolluted and artificially metal-polluted limno-corrals were analyzed for mercury, copper, cadmium, zinc and lead. On a dry weight basis, metal concentrations were highest in phytoplankton and periphyton samples, lower in zooplankton, chironomidae and Sialis and lowest in fish, indicating that inorganic Hg, Cu, Cd, Zn and Pb are not accumulated through the food chain and do not reach highest concentrations in highest trophic levels. The results further suggest that increased metal concentrations in the environment favor phytoplankton organisms with a lower metal sorption capacity. This negative feedback mechanism may play an important ecological role by reducing the metal content in organisms at lower trophic level, thereby reducing the danger of adversely affecting the organisms of higher trophic levels which feed upon them. (Deal-EIS)
W80-04900

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: EFFECTS OF INCREASED HEAVY METAL LOAD ON UPTAKE OF GLUCOSE BY NATURAL PLANCTONIC COMMUNITIES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
P. Bossard, and R. Gachter.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 261-270, 1979. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Heavy metals, *Inhibition, *Plankton, *Metabolism, Copper, Zinc, Cadmium, Lead, Mercury, Lakes, Seasonal, Water quality standards, Absorption, Carbon radioisotopes, Tracers, Natural selection, *Glucose.

Glucose uptake in lake water samples has been determined with short-time 14C-experiments at different additions of the single heavy metals Cu, Zn, Cd, Pb, Hg and at different additions of a combination of all metals. The degree of metal-induced inhibition of glucose uptake varied from lake to lake and from season to season. The addition of legally tolerated concentrations of 10 microg Cu/l and 200 microg Zn/l inhibited glucose uptake in most samples significantly, as well as the simultaneous addition of all metals. The legally tolerated limit of 1 microg Hg/l inhibited glucose uptake in Lake Lucerne samples almost completely, but showed no effect in samples of Lake Baldegg. The equimolar toxicity sequence of heavy metals for heterotrophic microorganisms has been determined as: Hg>Cu>Cd>(Zn, Pb). Glucose uptake of plankton sampled from metal polluted limno-corrals was less inhibited than that of the control plankton, when heavy metals were added to the samples singly or in combination. It is assumed that this effect is due to the natural selection of more resistant plankton species. (Deal-EIS)
W80-04901

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: OLIGOCHAETES AND CHIRONOMID LARVAE IN HEAVY METAL LOADED AND CONTROL LIMNO-CORRALS,
Conservation de la faune, Lausanne (Switzerland).
C. Lang, and B. Lang-Dobler.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 271-276, 1979. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Tubificids, *Diptera, *Toxicity, *Heavy metals, Dissolved oxygen, Water chemistry, Sediment-water interfaces, Benthic fauna, Primary productivity, Animal populations, Growth rates, Reproduction, Inhibition.

In two limno-corrals loaded with heavy metals the density of tubificid worms and chironomid larvae was higher than in the control. The better oxygen conditions observed in the heavy metal loaded corrals might explain this discrepancy. The higher oxygen concentration at the sediment-water interface was due to lower organic sedimentation, a consequence of the primary production reduced by heavy metals. In all limno-corrals, the tubificid populations consisted of Tubifex tubifex. The size structure of tubificid populations in the heavy metal loaded corrals indicated a delayed reproduction compared to the control. (Deal-EIS)
W80-04902

SMYRNA, DELAWARE SOLVES A WATER PROBLEM,
Delaware Div. of Public Health, Dover. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W80-04923

OFFSHORE SITING OF NUCLEAR POWER PLANTS,
Illinois Univ. at Urbana-Champaign.
J. W. Kindt.
Ocean Development and International Law Journal, Vol 8, No 1, p 57-103, 1980.

Descriptors: *Energy, *Nuclear powerplants, *Offshore platforms, *Water pollution sources, *Resources development, Jurisdiction, Legislation, International law, Environmental effects, Baseline studies, Floating, *Outer Continental Shelf, *Energy sources, Environmental impact, Law of the Sea, Site selection, *Floating Nuclear Plants(FNPs).

Of the newly suggested energy sources, nuclear power has the most immediate potential for solving predicted energy shortages in the U.S. during the next two decades. Nuclear power plants require approximately 500 acres of ground and a million gallons of cooling water per minute, but there are few remaining land sites in the U.S. which meet these requirements. One solution is to build floating nuclear plants (FNPs) and site them in the ecologically sensitive oceans. The environmental impacts of constructing and operating FNPs appear to be large; however, the domestic legislation of the U.S. can adequately regulate the problems associated with thermal discharge, perimeter contamination, and the risk of major accidents. On the international level, the U.S. needs to recognize the environmental and jurisdictional issues involving FNPs and then avoid potential FNP problems in the current law of the sea negotiations. (Sinha-OEIS)
W80-04942

DEEP WELL INJECTION FOR FLORIDA EFFLUENT.
World Water, Vol 3, No 1, p 22-23, January, 1980.

Descriptors: *Injection wells, *Waste disposal wells, *Sewage disposal, *Florida, Deep wells, Confined aquifers, Saline waters, Sewage effluent.

Deep well injection of sewage effluent is a viable alternative to deep-sea disposal for the Miami, Florida area if there are adequate safeguards to protect the Biscayne aquifer. The Floridan aquifer, even though saline with chloride counts ranging from 600 mg/l to 800 mg/l, also requires protection since it would be a potential source of drinking water if it were desalinated. The injection zone, a highly saline and permeable cavernous dolomite, is separated from the Floridan aquifer by 1000 feet of impermeable, dense carbonates. The effluent ultimately migrates to the Straits of Florida. When completed each of eight 24-inch injection wells will handle 10,000 gpm of effluent treated to 95% removal. It is claimed that deep-well disposal represents 10% of the operating cost and 1% of the maintenance cost for conventional tertiary treatment and deep-sea outfall facilities without the risk of beach pollution. (Purdin-NWWA)
W80-04984

INTERNATIONAL CONTROL OF DUMPING AT SEA,
For primary bibliographic entry see Field 6E.
W80-04993

HIGH FREQUENCY TEMPERATURE FLUCTUATIONS IN A POWER-PLANT THERMAL PLUME,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
T. Green, and S. Roffler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-184062, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Completion Report WIS WRC 80-06, 1980. 59 p, 22 Fig, 1 Tab, 25 Ref, Append. OWRT B-089-WIS(1), 14-31-0001-4141.

Descriptors: *Thermal powerplants, Powerplants, Water temperature, *Thermal pollution, Water cooling, Heated water, Thermocline, *Point Beach(Wis), Instrumentation, *Water temperature fluctuations, Wisconsin, *Lake Michigan, *Thermal plume, Aerial photography, Infrared radiation, Sampling, Measurement, Laboratory tests, Path of pollutants.

High-frequency temperature variations were measured at seven depths, from the water surface to three meters, at a point 130 meters from the cooling-water outfall of a power plant on Lake Michigan. The data are analyzed using spectra, correlation functions, and probability distributions. The sharp thermal fronts observed in the data are related to the surface thermal fronts seen using airborne infrared scanning, and to laboratory studies of instabilities in mixing layers between uniformly flowing and quiescent fluids.
W80-05009

AGRICULTURAL LAND USE: EFFECTS ON THE CHEMICAL QUALITY OF RUNOFF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
M. D. Smolen, and V. O. Shanholtz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-183163, Price codes: A05 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University. Bulletin 125, April 1980. 82 p, 24 Fig, 12 Tab, 18 Ref, Append. OWRT A-058-VA(3).

Descriptors: *Agriculture, *Agricultural runoff, Effects, *Water quality, *Nitrogen, *Phosphorus, Agricultural watersheds, Streamflow, Monitoring, Water analysis, Chemical analysis, Path of pollutants, Baseline studies, Uncultivated watershed, Rainwater quality, *Background water quality.

This research focused on changes in runoff quality when land is put under cultivation. The data will be used in later phases of research to evaluate chemical transport models. The 3 study watersheds, located in Virginia's southern Piedmont, had not been under cultivation for 30 years. During the research, 2 of the watersheds were put into agricultural production while the third was left uncultivated and used as a control. A grab sampling program was maintained on 2 watersheds for the full 5-year study period. Continuous streamflow gaging was maintained for the last 4 years. During the final 3 years, sampling and flow gaging were also maintained on a third watershed. Samples were analyzed for nitrate, ammonium, and total Kjeldahl nitrogen, orthophosphate and total phosphorus, bicarbonate alkalinity, pH, and specific conductance. Clear differences in streamflow characteristics were noted between the treated and the control watersheds. More surface runoff was observed in the treated watersheds than in the control, suggesting that increased surface runoff may have resulted from the cropping activity. All 3 watersheds exceeded the phosphorus criterion proposed by EPA, and a two-to-threefold increase in total phosphorus concentration was attributed to agricultural land use without employment of conservation practices. A twofold increase in total nitrogen concentration also was noted. Soluble inorganic nitrogen was present at a low concentration in the control watershed, but accounted for 20-30 percent of all nitrate nitrogen exported from the treated watersheds. The presence of nitrate nitrogen in the agricultural watersheds was the characteristic most attributable to agricultural activity.
W80-05012

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
C. J. Lensink, P. J. Gould, and G. A. Sanger.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 7-20, October 1979. 22 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Trophic levels, *Biology, *Habitats, Resources development, Water pollution sources, Environmental effects, Baseline studies, Alaska, *Outer Continental Shelf, Gulf of Alaska, Population dynamics, Petroleum development.

During 1978, studies of the breeding biology of seabirds were conducted at three locations in the Gulf of Alaska (Middleton Island, Sitkalidak Strait, and Chiniak Bay), and one location in Cook Inlet (Chisik Island). Studies on the trophic relationships of seabirds were conducted in the Kodiak area, primarily in Izhut and Kiliuda Bays, during the summer of 1978, and in Kachemak Bay during the winter of 1977-1978. The feeding habits of birds directly pertinent to breeding biology were studied at Sitkalidak, Chisik and Middleton. The selection of study sites was based on several factors, including their location in relation to OCS lease areas, the diversity of habitats, the species of seabirds present, the information available for each site, and the accessibility of each site. (Sinha-OEIS)
W80-05042

THE BREEDING BIOLOGY OF MARINE BIRDS ASSOCIATED WITH CHINIAK BAY, KODIAK ISLAND, 1975-1978,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
D. R. Nysewander, and D. B. Barbour.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 21-106, October 1979. 27 Fig, 19 Tab, 19 Ref, 3 Append, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-3538.

Descriptors: *Birds, *Breeding, *Ecology, Baseline studies, Environmental effects, Water pollution, Waterfowl, Alaska, Resources development, *Outer Continental Shelf, Petroleum development, Trophic relationships, Kodiak(AK).

Intensive studies of the breeding biology of marine birds were conducted at Chiniak Bay, Kodiak Island, in 1978 for the second consecutive year. The rate and annual variation of reproductive success was evaluated for black-legged kittiwake (Rissa tridactyla), tufted puffin (Lunda cirrhata), glaucous-winged gull (Larus glaucescens), mew

gull (Larus canus), pelagic cormorant (Phalacrocorax pelagicus), and red-faced cormorant (Phalacrocorax urile). Breeding phenologies were essentially the same in 1977 and 1978 for all species except pelagic cormorants. Productivity decreased in 1978 for all the major study species except tufted puffin. (Sinha-OEIS)
W80-05043

BREEDING BIOLOGY AND FEEDING HABITS OF SEABIRDS OF SITKALIDAK STRAIT,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
P. A. Baird, and M. A. Hatch.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 107-186, October 1979. 28 Fig, 21 Tab, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder. Colorado. NOAA-01-5-022-2538.

Descriptors: *Birds, *Breeding, *Food habits, Environmental effects, Baseline studies, Resources development, Water pollution effects, Alaska, Oil spills, Drilling, Leases, *Outer Continental Shelf, Petroleum development, Gulf of Alaska, Sitkalidak Strait.

The purpose of the OCSEAP studies was to define the role of seabirds in the Alaskan marine environment and to identify and evaluate potential impacts to the seabirds from the development of the petroleum reserves on the Alaska Outer Continental Shelf. Sitkalidak Strait with its important colonies on Cathedral Island and the adjacent Boulder Bay was identified as a key site to study. Reproductive success of seabirds is not constant from year to year but varies perhaps in accordance with fluctuations in the ecosystem. It is believed that one of the variables in the ecosystem which may influence reproductive success is food availability. Tufted puffins and arctic and Aleutian terns seemed to be most sensitive to human disturbance. Disturbance of the habitat for Arctic and Aleutian terns combined with egging produced very little reproductive output in the colony where this disturbance occurred. Presence of humans and their pets and any major habitat disturbance or destruction at the time before egg laying, and during the egg and chick stages tend to be detrimental to the productivity of the seabirds. (Sinha-OEIS)
W80-05044

REPRODUCTIVE ECOLOGY OF SEABIRDS AT MIDDLETON ISLAND, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
S. A. Hatch, T. W. Pearson, and P. J. Gould.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 233-308, October 1979. 24 Fig, 15 Tab, 23 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. NOAA-01-5-022-2538.

Descriptors: *Birds, *Breeding, *Food habits, *Ecology, Baseline studies, Environmental effects, Water pollution, Resources development, Oil pollution, Reproduction, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development, Middleton Island.

Studies of population, breeding phenology, productivity, and food habits of seabirds were conducted on Middleton Island from 22 April to 18 August 1978. Middleton Island lies about 50 miles southeast of Montague Island and 70 miles from the Alaskan mainland. The island harbors the largest colonies of several species of seabirds in the north-central Gulf of Alaska. It is situated almost directly in the path of the main Alaska Current and directly downstream from potential oil drilling or pumping operations. For these reasons, Middleton Island is deemed to be a site of key importance for baseline environmental study in the region. Particular emphasis was placed on the breeding phenology of seven species, on the productivity of black-legged kittiwakes and pelagic cormorants, and on the foods brought to nestling kittiwakes, rhinoceros auklets and tufted puffins. On the whole, breeding phenology of seabirds at Middleton Island was extraordinarily early and protracted relative to other colonies in the Gulf of Alaska. (Sinha-OEIS)
W80-05046

THE WINTER FEEDING HABITS OF SELECTED SPECIES OF MARINE BIRDS IN KACHEMAK BAY, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Ecosystems.
G. A. Sanger, R. D. Jones, Jr., and D. W. Wiswar.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 309-347, October 1979. 9 Fig, 8 Tab, 13 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-2538.

Descriptors: *Birds, *Food habits, *Winter, *Ecology, Baseline studies, Water resources, Resources development, Environmental effects, Food webs, Water pollution, Alaska, *Outer Continental Shelf, Cook Inlet, Trophic relationships, Petroleum development, Kachemak Bay.

From November 1977 to April 1978, marine birds were studied on Kachemak Bay, Alaska to determine their feeding habits and trophic relationships. Kachemak Bay, located at the southwest end of the Kenai Peninsula, Alaska, is a major geographic feature of lower Cook Inlet. It has long been recognized for its high biological productivity. Studies concentrated on oldsquaw, white-winged scoters, common murres and marbled murrelets. The birds ate 74 prey species in 11 major taxonomic groups. The birds in Kachemak Bay in winter appear to be largely dependent on a food web which has a detrital base. Because changes in distribution or abundance of food may be critical to survival of birds, changes in the structure of their food web(s) caused by development of petroleum resources may have major significance. This study, be determining types and importance of prey, will improve predictions of the consequences of environmental changes from petroleum activities. (Sinha-OEIS)
W80-05047

NEARSHORE FEEDING ECOLOGY OF MARINE BIRDS IN THE KODIAK AREA, 1978,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5C.
W80-05048

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA AND SOUTHERN BERING SEA. PART 11: NOTES ON THE WINTER SEABIRDS OF CHINIAK BAY, KODIAK ISLAND, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
M. Dick.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 492-516, October 1979. 3 Fig, 3 Tab, 11 Ref, Addendum, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Ecology, *Seasons, *Winter, *Data collections, Oil spills, Water pollution effects, Baseline studies, Environmental effects, Hazards, Summer, Alaska, Resources development, *Outer Continental Shelf, Trophic relationships, Population dynamics, Kodiak Island.

An annotated list of seabirds observed in Chiniak Bay during the winter of 1976-77 is presented. Included are observations and records by local observers, mostly fishermen. Outer Continental Shelf (OCS) studies to date in Alaska have not adequately assessed inshore winter bird distribution, abundance and trophic relationships. It would seem that the danger of an oil disaster inshore is greater in winter than in summer. If a disaster were to occur in winter, cleanup operations would likely be more difficult, and volatile components would not evaporate as fast. The effects of a winter oil spill are less easily assessed, because the bird populations involved are mostly not local; they come from many areas. The damage would not only affect the spill area, but also breeding grounds northward, westward, and in the interior of Alaska. The effects of a winter spill, however, might not be as lasting as a summer spill which involves whole colonies of breeding birds. It is recommended that more field crews be launched for safe but intensive winter field work in certain areas such as Kokiak, perhaps coordinated with boat surveys for ground truth. (Sinha-OEIS)
W80-05050

BACTERIA: WHAT'S IN THE WATER.,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8A.
W80-05064

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM GULF OF ALASKA, BERING AND BEAUFORT SEAS,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
I. R. Kaplan, M. I. Venkatesan, S. Brenner, E. Rugh, and J. Bonilla.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 597-659, October 1979. 16 Fig, 19 Tab, 45 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Organic matter, *Sediments, *Baseline studies, *Monitoring, *Path of pollutants, Oil pollution, Resources development, Water pollution effects, Environmental effects, Alaska, *Outer Continental Shelf, Gulf of Alaska, Bering Sea, Beaufort Sea, Norton Sound, Hydrocarbons, Biogenic hydrocarbons, Anthropogenic hydrocarbons.

Sediments were collected from the proposed lease areas of Beaufort Sea, Norton Sound, Kodiak Shelf and Cook Inlet during 1976-1978 and analyzed for total carbon, organic carbon, aliphatic and aromatic hydrocarbon contents. The objectives of the investigation are: (1) to establish the baseline hydrocarbon levels of sediment samples in the area, (2) to characterize the distribution and nature of these hydrocarbons, (3) to assess the possible source of the hydrocarbons in surface sediments, whether biogenic or anthropogenic, and (4) to understand the probably pathways of hydrocarbon transport in each of the areas in case of an oil spill. The baseline studies indicate that the sediment in the study areas is generally unpolluted. The characteristics of n-alkane hydrocarbons are typical of a mixture of marine and terrestrial components; with Norton Sound sediments containing the highest and Kodiak Shelf sediments, the lowest levels of terrigenous input. The distribution of polycyclic aromatic hydrocarbons is complex and shows a pyrolysis source in all the study areas. In addition, the presence of fossil arenes is indicated in Beaufort Sea sediments. (Sinha-OEIS)
W80-05065

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Battelle-Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5C.
W80-05066

POLLUTION: INTERNATIONAL CONVENTIONS, FEDERAL AND STATE LEGISLATION,

For primary bibliographic entry see Field 6E.
W80-05072

FEDERAL WATER POLLUTION CONTROL ACT - THE FEDERAL GOVERNMENT'S EXCLUSIVE REMEDY FOR RECOUPMENT OF OIL SPILL CLEANUP COSTS,
For primary bibliographic entry see Field 6E.
W80-05073

LAND USE CONTROLS IN COASTAL AREAS,
Kentucky Univ., Lexington
For primary bibliographic entry see Field 6E.
W80-05075

5C. Effects Of Pollution

NUTRIENT INTERACTIONS AND ALGAL QUALITY IN CAYUGA LAKE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
J. P. Barlow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180912, Price codes: A03 in paper copy, A01 in microfiche. Project Technical Completion Report to the Office of Water Research and Technology, April 1980. 33 p, 6 Fig, 3 Tab, 40 Ref. OWRT C-6054(No 5206)(1), 14-31-0001-5206.

Descriptors: Eutrophication, Algae, Diatoms, *Phosphorus, *Silicates, *Phytoplankton, *Growth rates, Lakes, New York, *Cayuga(NY).

Mixed phytoplankton from Cayuga Lake, N.Y. were subjected to perturbations of Si and P in continuous flow experiments. Diatom growth rates and cell quotas in late summer (July-August) were used to derive parameters for Droop's empirical growth equation. Using these parameters with Droop's relations it was possible to identify periods when diatom growth was controlled by P or Si, and to relate rate of growth to cell quotas during late summer. These same parameters did not, however, serve to relate observed growth rate to cell quotas at lower temperatures of experiments run in spring and early summer (May-June). It is shown that it would require as much as 2-5X changes in size of these parameters to relate growth to cell quotas at these lower temperatures, and that it would also require equivalent increases in cell quotas to maintain the same rate of nutrient controlled growth at the lower temperatures. Estimates of cell quotas of the natural lake community suggest that seasonal changes in diatom abundance is probably not controlled by Si-depletion, and that in summer diatom growth is controlled by P.
W80-04801

WASTEWATER RECYCLING: DEVELOPMENT OF PLANT DISEASE IN AN OLD FIELD ECOSYSTEM,
Michigan State Univ., East Lansing. Dept. of Botany.
For primary bibliographic entry see Field 3C.
W80-04805

AN AVOIDANCE RESPONSE BIOASSAY FOR AQUATIC POLLUTANTS,
Kentucky Water Resources Research Inst., Lexington.
J. A. Black, and W. J. Birge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180490, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 123, 1980. 40 p, 7 Fig, 3 Tab, 38 Ref. OWRT A-077-KY(1), 14-34-0001-8019(FY-78), 14-34-0001-9019(FY-79).

Descriptors: *Heavy metals, *Avoidance response, *Behavior, *Fish, Amphibia, Water quality, *Bioassay, Pollutants, Toxicity, *Attraction, *Juvenille fish, Embryo-larval tests.

Avoidance response bioassays were conducted with eight aquatic contaminants, including cadmium, copper, mercury, zinc, chloroform, dioctylphthalate (DOP), trisodium nitrilotriacetic acid (NAT), and phenol. Tests were performed in a dual-channel fluviarium system, and the toxicant injection procedure used provided good regulation of exposure concentrations. Juvenille stages of largemouth bass (Micropterus salmodes), bluegill, sunfish (Lepomis macrochirus), and rainbow trout (Salmo gairdneri), and tadpoles of the American toad (Bufo amaricanus) proved to be suitable animals for evaluating avoidance or attraction responses. The trout was the most sensitive species tested. Avoidance was significant in tests with cadmium, phenol, and zinc, and significant attraction resulted from exposures to chloroform, DOP, and mercury. Animals generally avoided lower concentrations of copper but were attracted to higher exposure levels. NTA produced variable responses. In tests with trout, threshold concentrations for avoidance or attraction were estimated to fall at 0.0002 mg/l mercury, 0.047 mg/l zinc, 0.052 mg/l cadmium, 0.074 mg/l copper, 11.9 mg/l chloroform, and 56.6 mg/l NTA. The threshold for phenol, determined using bluegill, was 39.0 mg/l. Results from fish embryo-larval toxicity tests were used to gauge sensitivity of the avoidance response bioassay. Toxicant concentrations which produced embryo-larval lethality or teratogenesis at frequencies of 10% (LC10) and 1% (LC1) were compared. (Huffsey-Kentucky)
W80-04806

MICRO-ORGANIC COMPOUNDS IN THE WATER ENVIRONMENT AND THEIR IMPACT ON THE QUALITY OF POTABLE WATER SUPPLIES,
Water Research Commission, Pretoria (South Africa).
G. J. Stander.
Water S. A., Vol 6, No 1, p 1-14, January 1980. 6 Fig, 19 Tab, 25 Ref.

Descriptors: *Organoleptic properties, *Organic compounds, *Water quality, *Water pollution sources, *Potable water, Odor, Taste, Water properties, Chemical analysis, Pollutant identification, Toxicity, Water pollution effects, Water chemistry, Chlorination, Water purification.

An evaluation of the reported literature on micro-organics in water was used to develop a plan for the optimum utilization of South Africa's limited water resources. Micro-organic compounds in the water environment came from return flows from waste water treatment facilities, urban and agricultural runoff, and atmospheric precipitation. Recently developed improved analytical techniques have resulted in the identification of more than one thousand organic compounds at very low concentrations. These compounds have been classified into 22 groups that are listed with the number of compounds in each group. Frequencies of detection in drinking water and their highest concentrations are also given. Toxicity ratings are given for the approximately 60 compounds reported in drinking water by the American Waterworks Association. Despite much alarm there is very limited evidence that micro-organics in drinking water are connected to health problems. Epidemiological studies are needed to further evaluate the significance of micro-organics in water quality. Tastes and odors in drinking water caused by organic compounds in micro-concentrations especially from chlorination are discussed. Overall there is agreement that the current conventional water purification processes can effectively provide healthy safe drinking water, however, South Africa should adopt a plan of prevention rather than cure to ensure the health safety of public water supply systems. (Seigler-IPA)
W80-04883

HEALTH CONSIDERATIONS IN THE PREPARATION OF DRINKING WATER FROM THE RIVER RHINE,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
C. L. M. Poels,.
Water S. A., Vol 6, No 1, p 15-20, January 1980. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Rhine River, *Potable water. *Rainbow trout, *Water quality, *Chromosomes, Cytological studies, Toxicity, Public health, Water pollution, Water purification, Aquatic bacteria, Organic compunds, Minnows, Fish eggs, Fish reproduction.

The toxicity of Rhine River water to rainbow trout was studied as part of an assessment of the safety of drinking water prepared from river water. Four experiments were conducted: (1) determination of the chronic toxic quality of Rhine water and its effects on rainbow trout; (2) determination of the effects of Rhine water on egg and juvenile development of rainbow trout; (3) introduction of cytogenetic effects of Rhine water in fish; and (4) introduction of mutations in bacteria by Rhine water extracts. A brief general description of experimental design is given for each experiment along with a discussion of results. From the overall results it is concluded that: (1) Rhine water is chronically toxic to rainbow trout; (2) rainbow trout are unable to complete normal life cycles in Rhine water due to high egg mortality rates; (3) chromosome breaks occur in the gills of the eastern mudminnow when exposed to Rhine water; and (4) mutations are induced in bacteria exposed to the fraction of armoatic hydrocarbons found in Rhine water. From these results it is concluded that chronic exposure to Rhine water can be harmful to water organisms. While these conclusions are based on experiments with fish, and little is known about the relationship of fish susceptibility and human susceptibility, the use of Rhine water in the preparation of drinking water should receive further careful research. (Seigler-IPA)
W80-04884

STUDY OF THE BENTHIC POPULATIONS OF SOFT SUBSTRATES OFF THE OUTFALL OF THE MAIN SEWER OF MARSEILLE. 1. GENERAL DATA ON THE ENVIRONMENT AND POPULATIONS (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
J. C. Romano.
Tethys, Vol 9, No 2, p 113-121, 1979. 6 Fig, 10 Tab, 7 Ref. (English Summary).

Descriptors: *Sewage effluents, *Toxicity, *Aquatic populations, Benthic fauna, Outlets, Sewage disposal, Dissolved oxygen, Domestic wastes, Municipal wastes, Water chemistry, Chlorination, Dominant organisms, Marseille, Mediterranean, *Capitella, *Nereis, *Scolelepis, France.

Almost all the waste water of Marseilles discharge into the sea at the 'calanque de Cortiou'. The influence of the pollution on benthic populations of soft bottom shows the existence of concentric areas in front of the outlet of the sewage. Seven stations were studied every month for one year. In this paper, some characters of populations are described using a yearly mean for each station. Correlations are established between nature of populations and natural conditions. A microrepartition of these populations is pointed out. (Deal-EIS)
W80-04888

CADMIUM, ZINC AND COPPER ACCUMULATION IN LIMPETS (PATELLA VULGATA) FROM THE BRISTOL CHANNEL WITH SPECIAL REFERENCE TO METALLOTHIONEINS,
Liege Univ. (Belgium). Lab. d'Oceanography.
For primary bibliographic entry see Field 5B.
W80-04893

CONCENTRATION AND DISTRIBUTION OF URANIUM IN MYTILUS EDULIS AND ASSOCIATED MATERIALS,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5B.
W80-04895

ACCUMULATION AND BIOLOGICAL EFFECTS OF CADMIUM IN RAINBOW TROUT,
Tokai Regional Fisheries Research Lab, Yokosuka (Japan). Arasaki Marine Biological Station.

For primary bibliographic entry see Field 5B.
W80-04896

INFLUENCE OF COPPER AND ZINC IN FOOD SUBSTANCE ON THE ACCUMULATION OF CULTURED OYSTERS (IN JAPANESE),
Iwate Prefectural Office (Japan). Forestry and Fishery Div.
For primary bibliographic entry see Field 5B.
W80-04897

DEGREE OF DISPERSION OF THE ZACO TEMMINCKI SCHOOL TO WATER QUALITY IN A STREAMING WATER TROUGH (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan).
M. Inoue, T. Arimoto, and I. Kono.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 12, p 1485-1490, 1979. 2 Fig, 7 Tab, 5 Ref, (English abstract).

Descriptors: *Fish behavior, *Toxicity, *Water pollution, Bioindicators, Detergents, Schools(Fish), Water quality, Social behavior(Animal), Analytical techniques, Water chemistry, Rheotropism, Bioassay.

In a preliminary observation on the schooling behaviour of three kinds of river fish (Zacco temmincki, Tribolodon hakonensis, and Morco steindachneri), which were composed of three fish each, it was found that the school of Z. temmincki showed the most concentrated schooling behaviour at a certain position in the water trough compared with the other two kinds of fish. Using this behaviour of Z. temmincki, the relation between the degree of dispersion of the school and the water quality was examined and the following results were obtained. The degree of dispersion of the Z. temmincki was obviously affected by the water samples taken from three stations of the Tama river and it was also found to be affected by the difference of water quality caused by the degree of synthetic detergent ABS contained. (Deal-EIS)
W80-04898

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: OLIGOCHAETES AND CHIRONOMID LARVAE IN HEAVY METAL LOADED AND CONTROL LIMNO-CORRALS,
Conservation de la faune, Lausanne (Switzerland).
For primary bibliographic entry see Field 5B.
W80-04902

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: EFFECTS OF INCREASED HEAVY METAL LOAD ON CRUSTACEA PLANKTON,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
J. Urech.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 247-260, 1979. 5 Fig, 7 Tab, 31 Ref.

Descriptors: *Heavy metals, *Crustaceans, *Zooplankton, *Toxicity, Growth rates, Inhibition, Growth stages, Mercury, Copper, Cadmium, Zinc, Lead, Lakes, Mode of action, Mortality, Zooplankton fecundity.

The crustacea plankton of three artificial model lakes in Lake Baldegg was observed during 15 months. Two were loaded continuously with low concentrations of five heavy metals (Hg, Cu, Cd, Zn, Pb). We attempted to explain the significant lower abundances of the loaded limno-corrals. The results suggest that the decrease was not, or only partially, caused by the lower food supply in the loaded limno-corrals, but directly by the heavy metals. Accompanying laboratory tests show significantly increased egg-development-times for two species of those animals from the loaded limno-corrals. It cannot be determined if increased mortality of particular animal stages was caused by heavy metals. (Deal-EIS)
W80-04903

MELIMEX, AN EXPERIMENTAL HEAVY METAL POLLUTION STUDY: EFFECTS OF INCREASED HEAVY METAL LOADS ON PHYTOPLANKTON COMMUNITIES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
R. Gachter, and A. Mares.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 228-246, 1979. 10 Fig, 3 Tab, 40 Ref.

Descriptors: *Heavy metals, *Toxicity, *Phytoplankton, On-site-investigation, Mercury, Copper, Cadmium, Zinc, Lead, Biomass, Photosynthesis, Inhibition, Adaptation, Zooplankton, Seasonal, Dominant organisms, Amino acids, Biochemistry, *Species diversity.

Long-term impacts of increased metal loading (Hg, Cu, Cd, Zn and Pb) on phytoplankton communities of large limno-corrals (diameter 12 m. depth 10 m) were studied. Increased metal concentrations initially lowered phytoplankton biomass, as well as species number and photosynthetic activity of phytoplankton. They caused changes in metal speciation and shifts in phytoplankton community structure, favoring less susceptible species. Although adaptation was not sufficient to completely prevent the metal-induced depression of photosynthesis, due to depressed zooplankton grazing, at the end of the experiment even higher phytoplankton densities were observed in the metal-loaded corrals than in the control. (Deal-EIS)
W80-04904

EFFECTS OF INGESTED CRUDE OIL ON BLACK GUILLEMOTS: A COMBINED FIELD AND LABORATORY STUDY,
Canadian Wildlife Service, Ottawa (Ontario). Wildlife Toxicology Div.
D. B. Peakall, D. Hallett, D. S. Miller, R. G. Butler, and W. B. Kinter.
Ambio, Vol 9, No 1, p 28-30, 1980. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Oil, *Toxicity, *Water birds, Analytical techniques, Methodology, On-site data collections, Oil pollution, Growth rates, Growth stages, Mode of action, Weight, Path of pollutants, *Tissue analysis, *Black guillemot, *Cepphus.

The experiment presented here was performed using a new experimental design for assessing pollutant toxicity. The technique permits carefully controlled experimentation on seabirds living normally in their chosen habitat, and is based on the observation that nestling black guillemots remain in their nest cavity for as long as 40 days after hatching during which period the adults continue to feed their young despite occasional disturbance by investigators handling the young for dosing and/or sampling. Toxicity studies thus made on individual nestlings involve minimal disruption of their normal way of life. At any point in the experiment, live birds or tissue samples can be transported to a laboratory for detailed physiological, biochemical and histological studies. The technique was then employed using a single dose of weathered crude oil. The data on the effect of oil on body weight suggest that a single dose of weathered crude oil could cause serious effects. Black guillemots which were dosed when they were roughly two weeks of age (about 125 g body weight) exhibited significantly smaller gains in body weight over the next three weeks than corresponding controls. At about five weeks of age (within one week of fledging), these experimentals were 20 percent lighter than controls. Since many oceanic bird species disperse into the open sea (alcids) or undertake long migrations (petrels) immediately after fledging one would expect that these lighter birds might be less able to survive this major period of stress. (Deal-EIS)
W80-04905

EFFECTS ON FISH EXPOSED TO EFFLUENT FROM A TITANIUM DIOXIDE INDUSTRY AND TESTED WITH ROTATORY-FLOW TECHNIQUE,
Institutet for Vatten- Och Luftvardsforskning, Stockholm (Sweden).
For primary bibliographic entry see Field 5A.
W80-04906

INFLUENCE OF SUMMER DROUGHT ON THE POPULATION OF AQUATIC INSECTS IN A TEMPORARY SALT-MARSH IN THE CRAU DISTRICT (MOUTH OF THE RIVER RHONE) (IN FRENCH),
Aix-Marseille-I Univ. (France). Lab. for Animal Biology-Ecology.
A. Thiery.
Annales Limnologie, Vol 15, No 2, p 181-191, 1979. 3 Fig, 11 Ref, (English Summary).

Descriptors: *Growth stages, *Droughts, *Insects, *Adaptation, Aquatic insects, Seasonal, Summer, Life cycles, Larval growth stage, Salt marshes, Dominant organisms, *Berosus, River Rhone, France.

In a temporary salt-marsh in Crau, the only insects adapted to the summer drought are species in the Hydrophilidae (Coleoptera), especially the dominant species Berosus guttalis. The life cycle of this species is described, and it is shown that, at the time of the drought, almost 80% of the larvae are in Stage III which is proved to be essential for pupation. This synchronization of larval development and summer drought ensure that the species has the highest chance of survival. (Deal-EIS)
W80-04907

A STUDY OF PERIPHYTON IN A POLLUTED RIVER (L'AGOUT) I. STRUCTURE AND DEVELOPMENT OF COMMUNITIES ON ARTIFICIAL SUBSTRATA. (IN FRENCH),
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
J. Capblancq, and M. Cassan.
Annales Limnologie, Vol 15, No 2, p 193-210, 1979. 6 Fig, 1 Tab, 25 Ref. (English Summary).

Descriptors: *Periphyton, *Growth rates, *Metabolism, Biomass, Bioindicator, Water pollution, Benthic flora, Aquatic bacteria, Aquatic algae, Dominant organisms, Biological communities, Sphaerotilus, *Artificial substrates.

Artificial substrata, replaced every 20 days from June to November, have been used to study the production and structure of the community of benthic microphytes in a 50 km-section of a polluted river. The periphyton of this environment, largely dominated by the filamentous bacterium Sphaerotilus natans, is characterised by the poor development of algae and by rapid growth. The spatial and temporal changes in the growth rate of the phototrophic (P) and heterotrophic (H) communities, as well as the biomass ratio (P/H) and specific composition the biocoenosis, are related to the variations in the load of pollutant. The possibilities of utilising such indices for characterising levels of organic pollution are discussed. (See also W80-04909) (Deal-EIS)
W80-04908

A STUDY OF PERIPHYTON IN A POLLUTED RIVER (L'AGOUT) II. METABOLISM AND DYNAMICS OF GROWTH ON ARTIFICIAL SUBSTRATA, (IN FRENCH),
Institutet for Vatten- Och Luftvardsfor skning, Stockholm (Sweden).
J. Capblancq, and M. Cassan.
Annales Limnologie, Vol 15, No 2, p 211-222, 1979. 6 Fig, 21 Ref. (English Summary).

Descriptors: *Periphyton, *Growth rates, *Metabolism, Biomass, Bioindicators, Monitoring, Water pollution, Oxygen demand, Benthic flora, Water purification, Carbon radioisotopes, Tracers, *Artificial substrates, *Glucose.

Weekly samples from artificial substrata submerged at a point in a polluted river were used to follow the growth of periphyton over periods of 28 days. The biomass is chiefly filamentous bacteria and the changes in biomass show that the specific growth rate of benthic microphytes decreases as a function of the immersion period of the

substrata. It is the same for the metabolic activity of the periphyton, measured in the laboratory by the rate of oxygen consumption and by the assimilation kinetics of organic substances (14C-glucose). The contribution of benthic microphytes to the purification process and the results provided by artificial substrata are discussed. (See also W80-04908) (Deal-EIS)
W80-04909

THE EFFECT OF LEAD, CADMIUM, AND MERCURY ON THE INCREASE IN LENGTH OF FIVE INTERTIDAL FUCALES,
Trondheim Univ. (Norway). Museum.
T. Stromgren.
Journal of Experimental Marine Biology and Ecology, Vol 43, p 107-119, 1980. 6 Fig, 1 Tab, 31 Ref.

Descriptors: *Growth rates, *Phaeophyta, *Cadmium, *Lead, *Mercury, Heavy metals, Marine algae, Plant growth, Seasonal, Toxicity, Mode of action, Peluctia, Fucus, Ascophyllum, Growth enhancement.

The increase in length of Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, F. serratus, and Ascophyllum nodosum was measured in various concentrations of lead, cadmium, and mercury during a period of 9-10 days. Concentration ranges of the three metals were 45-2600 microg/l, 1.5-1040 microg/l, and 0.9 1250 microg/l, respectively. Significant reductions of growth rate compared with the controls were observed at > 810 microg/l of lead, > 450 microg/l of cadmium, and > 10 microg/l of mercury, and significant regressions of growth reduction on log concentration were indicated. Growth was significantly enhanced in Pelvetia canaliculata and Ascophyllum nodosum when exposed to cadmium, and in this case there was a significant regression of growth increase on log concentration. The growth of Pelvetia canaliculata was also enhanced at all concentrations of lead. (Deal-EIS)
W80-04910

INFLUENCE OF COPPER SULPHATE ON THE STRUCTURE OF THE NET OF LARVAE OF HYDROPSYCHE (INSECTA, TRICHOPTERA), (IN FRENCH),
Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (Germany, F.R.).
W. K. Besch, I. Schreiber, and E. Magnin.
Annales Limnologie, Vol 15, No 2, p 123-138, 1979. 17 Fig, 11 Ref. (English Summary).

Descriptors: *Copper sulfate, *Toxicity, *Insects, Animal behavior, Animal physiology, Mode of action, Copper compounds, Larval growth stage, Bioindicator, Bioassay, Methodology, Aquatic insects, *Hydropsyche.

Copper sulphate with an initial concentration as low as 125 microg Cu/l in hard water adversely affects the capacity of the larvae of Hydropsyche to spin nets. The irregularity that is first apparent is the high number of thread-interruptions. At higher concentration, the number of meshes per net decreases. A typical anomaly of the toxic action of copper is the deposition of threads as cotton-like harks instead of net tissues. The symmetry and regularity of the meshes in the catching area is only slightly affected by copper. This contrasts strikingly with the effects of a carbamate insecticide studied earlier. The primary site of the action of copper seems to be the silk gland and not the nervous system as is the case with the above pesticide. The findings in the laboratory confirm those made in the field. Concentrations which severly impair net construction are prohibitive for occurrence in nature. The Hydropsyche-test requires only short test-times and simple equipment and yet gives information on long term effects. (Deal-EIS)
W80-04911

THE DIFFERENT ADAPTABILITY OF FISH TO EUTROPHICATION, (IN GERMAN),
Staatliches Inst. fuer Seenforschung und Fischereiwesen, Langenargen (Germany, F.R.).
J. Hartmann.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 374-382, 1979. 3 Fig, 2 Tab, 19 Ref. (English abstract).

Descriptors: *Eutrophication, *Lakes, *Fish populations, Yield equations, Adaptation, Water pollution, Perches, Dominant organisms, Salmonids, Commercial fish, Fish physiology, European lakes, Yellow perch, Pike, *Coregonus, *Abramis, Tinca.

The succession of yield of 10 fish species or genera in European lakes undergoing cultural eutrophication is described. Non-pelagic species often display no yield increase, whereas potential pelagic ones do for a time. Coregonus spp. and Perca fluviatilis exhibit yield increase and intensified yield fluctuations. A decrease of yield of the combined Coregonus spp. rarely has been observed in lakes with a mean depth more than 50 m. In respect to adaptability to rapid eutrophication, from yield patterns and changed biology three groups of fish are distinguished: (1) preadapted fish, as Stizostedion lucioperca; (2) obviously adapting ones, represented by potential pelagic-planktivorous species as Rutilus rutilus and P. fluviatilis; (3) not obviously adapting ones which include littoral fish as Esox lucius and Tinca tinca. (Deal-EIS)
W80-04912

INFLUENCE OF HYDROCARBONS ON ECOLOGY OF BACTERIA IN AEROBIC LAKE SEDIMENT, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
H. Buhrer.
Schweizerische Zeitschrift fur Hydrologie, Vol 41, No 2, p 315-355, 1979. 12 Fig, 13 Tab, 51 Ref.

Descriptors: *Oil, *Toxicity, *Bacteria, *Bottom sediment, Oil pollution, Lakes, Aerobic bacteria, Chemical analysis, Chlorophyta, Ecosystems, Growth rates, Dominant organisms, Water pollution effects.

Two different hydrocarbon loadings of sediment cores were analyzed 4 times during 21 days. Applied methods were: Direct count, isolation of more than 100 colonies on a diluted plate-count agar and estimation of 42 attributes (282 levels), followed by a single link clustering and calculation of the information basing on attribute level (i.e. negative entropy). Loading of 100 g fuel oil/sq m sediment caused a depletion of germs and information. Full restoration could not be observed. When 10 g fuel/sq m was applied there was no significant effect, but if algae were supplied too, the effect was similar to using 100 g/sq m. An extrapolation of the results gives a tolerance of hydrocarbon loading for Lake Constance or Lake Zug of 10 to 20 times the load present, but effects on fishes or fishfood were not considered. (Deal-EIS)
W80-04913

OIL SPILLS: A PUBLIC OFFICIAL'S HANDBOOK,
State Univ. of New York Coll. at Potsdam. Dept. of Anthropology.
J. T. Omohundro.
Cornell University Extension Publication, Information Bulletin 166, Social Sciences Sea Grant 3, March 1980. 19 p, 21 Ref.

Descriptors: *Oil spills, *Social aspects, Oil pollution, Water pollution treatment, Pollution abatement, *Public officials, Emergency action, Rehabilitation, *Handbook.

This handbook explains the social response to an oil or hazardous substance spill, particularly in water. The reactions of the victims and coastal residents of the impacted area are identified, and actions that may reduce social problems are suggested. The last section, 'Suggestions for Planning and Response,' may be consulted immediately in the event of a spill. An emergency checklist on the back cover addresses specific actions and guides the reader to appropriate sections of this handbook. The quick reference charts 1, 2, and 3 may serve as memory aids to the social context of particular problems. Official should find this handbook useful in preparing for public meetings and news conferences, in conducting personal interviews while reconnoitering or administering in the impacted area, and in handling telephone and written requests for information or help. (NOAA)
W80-04938

OIL SPILLS: A COASTAL RESIDENT'S HANDBOOK,
State Univ. of New York Coll. at Potsdam. Dept. of Anthropology.
J. T. Omohundro.
Cornell University Extension Publication, Information Bulletin 164, Physical Sciences Sea Grant 2, March 1980. 15 p, 5 Ref.

Descriptors: *Oil spills, *New York, *Great Lakes, *Coasts, Water pollution control, Pollution abatement, Water pollution treatment, *Human population, Emergency action, Area residents, *Handbook, Regional response team.

People living on or using the water bodies within and bordering New York State will find this bulletin valuable in case of an oil spill emergency. Knowledge of what can happen and what can be done in case of a spill emergency may save needless confusion, anxiety, and loss or damage. The first half of this bulletin explains what happens in a spill and what official parties will do. The self-help advise in the second half of this bulletin may reduce loss and damage to property owners or sportsmen on Lake Erie, Lake Ontario, the Saint Lawrence Seaway, Lake Champlain, the Hudson River, the Barge Canal System, New York Harbor, Long Island Sound or the Atlantic Ocean. The bulletin should be kept handy as a reference in time of emergency. (NOAA)
W80-04939

FISHING AND NORTH SEA OIL,
Department of Agriculture and Fisheries for Scotland, Edinburgh.
G. P. S. MacArthur.
Scottish Fisheries Bulletin 43, p 27-31, 1976.

Descriptors: *Fishing, *Oil industry, *Water pollution effects, Resources development, Oil pollution, Oil spills, Environmental effects, Outer Continental Shelf, North Sea, Environmental impact, Petroleum development.

Consultations between the fishermen and oil-men who share the North Sea, fall into two broad categories; direct consultations between representatives of fishermen and an individual oil company concerning a specific offshore development; and the broader consultations which take place in the Fisheries and Offshore Oil Consultative Group (FOOCG), on which both industries are represented. Under the auspices of FOOCG a factual study has been made to ascertain as far as possible the effect of North Sea Oil and gas installations on access to fishing grounds. Although a broad assessment of the effect can be made on the basis of a number of assumptions the study disclosed, there are difficulties in attempting to quantify the precise effect. The areas involved are small in relation to fishing patterns, which themselves undergo change for reasons unrelated to offshore developments. As offshore exploration continues and finds already made and finds still to be made are exploited it is all the more important to ensure that these offshore activities interfere with fishing as little as possible. (Sinha-OEIS)
W80-04941

OFFSHORE SITING OF NUCLEAR POWER PLANTS,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 5B.
W80-04942

SEA OTTER DISTRIBUTION AND ABUNDANCE SOUTHERN KODIAK ARCHIPELAGO AND THE SEMIDI ISLANDS,
Alaska Dept. of Fish and Game, Anchorage.
K. Schneider.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investi-

gators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 169-191, October 1979. 12 Fig, 12 Tab, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Mammals, *Otters, *Oil pollution, *Water pollution effects, Environmental effects, Baseline studies, Ecology, Resources development, Alaska, *Outer Continental Shelf, Kodiak Island, Semidi Islands, Petroleum development.

Sea otters have been sighted throughout the shallow waters southeast of Kodiak Island but established breeding groups occupy only two areas. The largest colony inhabits the waters south of the Trinity Islands and is roughly estimated to number between 400 and 700 sea otters. A second concentration of less than 100 sea otters exists around Chirikof Island. Sea otter densities in these areas are believed to be well below the capacity of the habitat but numbers are increasing. Both colonies are vulnerable to oil spills because of their small size, limited distribution and proximity to proposed OCS lease tracts. Sea otters have been present in the Semidi Islands at least since 1957. The present population is small (30 to 50 animals) and not occupying all available habitat. (Sinha-OEIS)
W80-04946

BELUKHA WHALES IN LOWER COOK INLET,
Alaska Dept. of Fish and Game, Anchorage.
N. Murray.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 192-208, October 1979. 1 Fig, 28 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Mammals, *Oil pollution, *Water pollution effects, Baseline studies, Ecology, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Cook Inlet, *Belukha whales.

The Cook Inlet belukha population has been estimated at 300 to 400, and is thought to be resident in the Inlet year-round. Sighting data confirms that belukhas are present in all seasons. Belukhas are seasonally distributed in the different regions of the Inlet. They have been sighted in the Upper Inlet primarily in late spring and summer. Belukhas are seen throughout the year in the central and lower areas, with heaviest use occurring in the central Inlet area. Within the Inlet, numbers appear to fluctuate seasonally, with the greatest number seen in mid to late summer and the fewest in winter. Ice conditions may have a strong correlation with winter abundance. The habitat types used by belukhas appear to fall into four categories: migration routes, feeding grounds, breeding grounds and calving/nusery grounds. Food resources may be the critical element determining the interrelationship of habitat requirements. The habitat requirements vary seasonally and with the age and sex of the whale. The seasonal variations are dynamic and introduce difficulties in determining simple habitat requirements. (Sinha-OEIS)
W80-04947

ECOLOGICAL STUDIES OF BIRDS IN THE NORTHERN BERING SEA: SEABIRDS AT BLUFF, DISTRIBUTION OF BIRDS AT SEA, MOVEMENTS OF BIRDS IN THE BERING STRAIT,
College of the Atlantic, Bar Harbor, ME.
C. Ramsdell, and W. H. Drury.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 600-769, October 1979. 27 Fig, 32 Tab, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35208.

Descriptors: *Birds, *Waterfowl, *Shore birds, *Oil pollution, *Water pollution effects, Environmental effects, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, Petroleum development, Bering Sea, Bering Strait.

The goal of this study is to assess the present environmental conditions in the northern Bering Sea and Bering Strait while specific objectives are to determine the breeding areas and seasonal changes in density and distribution of the principle seabird species; and to describe the trophic relations of selected species. Studies were concentrated on two numerous and widespread species, Common Murres and Black-legged Kittiwakes, because they are convenient to study and offer opportunity to compare results with those obtained by others in other parts of these well-studied species' ranges. Some of the most obvious effects of hydrocarbon exploration and transport on birds may include: (1) direct disturbance by the presence of and activities associated with heavy equipment; (2) pollution of the waters by hydrocarbons and other industrial chemicals; (3) direct disturbance by increased human activity associated with development; (4) secondary effects reflecting increased land development for support facilities and transportation corridors; (5) secondary effects reflecting the recreational demands of additional people travelling off regular transportation corridors; (6) effects of increased human activities involving species which are sensitive to disturbance by humans or which attract human hunting or curiosity; (7) effects of human activities that will provide a sibsidy for aggressive species able to take advantage of resources, e.g., food from wastes; and (8) secondary effects of the impact of aggressive species benefitting from human development, on sensitive species vulnerable to competition. (Sinha-OEIS)
W80-04951

SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS AND TRACE METALS, INCLUDING BIOTRANSFORMATIONS, AS REFLECTED BY MORPHOLOGICAL, CHEMICAL, PHYSIOLOGICAL, PATHOLOGICAL, AND BEHAVIORAL INDICES,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins, H. O. Hodgins, N. L. Karrick, and D. D. Weber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 60-171, October 1979. 22 Fig, 18 Tab, 85 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120819.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, *Aquatic life, Alaska, Resources development, Pathology, Fish diseases, Vertebrates, Invertebrates, *Outer Continental Shelf, Petroleum development.

The overall objective of this program was to assess potential effects of petroleum and petroleum-related operations on marine organisms indigenous to Alaskan waters. Several principal objectives addressed by this research were: (1) to evaluate the effect of petroleum on sensory systems and behavior of marine species by determining if petroleum in sediment causes flatfish to avoid the contaminated area or interferes with normal feeding and activity patterns, and evaluating the effect of crude oil exposure on defensive behavior of a sea urchin; (2) to investigate the metabolism and disposition of petroleum hydrocarbons in demersal fish; (3) to develop and refine ultrastructural criteria for assessing cellular damage in marine organisms resulting from exposure to petroleum; (4) to detect and characterize pathological changes resulting from the exposure of flatfish to sediments contaminated with crude oil and to detect effects of petroleum exposure on flatfish disease resistance; and (5) to determine if petroleum-exposed eggs and larvae of salmon and flatfish develop abnormally, and to evaluate the effect of any detected abnormalities on survival. The conclusions of this program are summarized according to disciplinary areas of study. Research findings from this program have clear implications with respect to petroleum effects on aquatic species and consequently to OCS oil and gas development. (Sinha-OEIS)
W80-04954

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. SECTION I - AVIAN ECOLOGY IN SIMPSON LAGOON, BEAUFORT SEA, ALASKA,
LGL Ltd., Edmonton (Alberta).
S. R. Johnson.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 238-362, October 1979. 7 Fig, 31 Tab, 35 Ref, 2 Append, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35193.

Descriptors: *Birds, *Ecology, *Habitats, *Environmental effects, Alaska, Migration, Breeding, Resources development, Oil industry, *Outer Continental Shelf, Petroleum development, Feeding, Molting, Beaufort Sea, Simpson Lagoon.

The general scope of the ornithological components of this study, which was sited primarily in the Simpson Lagoon area, was to characterize the use of nearshore habitats by birds and to clarify those critical feeding and habitat dependencies that development is likely to affect either directly, or indirectly via alteration of ecosystem processes. The research program addresses four ecosystem uses/dependencies of birds--for migration, breeding, feeding and staging-molting. These uses are evaluated as they relate to barrier island-lagoon habitats and predicted development alterations of habitats. Some general conclusions were that: (1) bird utilization of nearshore lagoon areas was minimal while these areas remained frozen in spring and early summer so that potential impacts of development are probably low at this time except for those activities that would create open water attractive to birds; (2) heaviest use of near-shore barrier island-lagoon areas by birds occurred during the open-water season--late July through August and September. Primary use of the area at this time was by molting and migrating oldsquaws and staging shorebirds. Feeding activity in the area was intensive by all these birds. Potential impacts of development would be most serious during this open-water season. (Sinha-OEIS)
W80-04956

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. ECOLOGY OF INVERTEBRATES IN SIMPSON LAGOON, BEAUFORT SEA, ALASKA,
LGL Ltd., Edmonton (Alberta).
W. B. Griffiths, and R. E. Dillinger.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 471-600, October 1979. 28 Fig, 22 Tab, 74 Ref, 10 Append, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35193.

Descriptors: *Invertebrates, *Ecology, *Oil pollution, *Sediments, *Environmental effects, *Water pollution effects, Lagoons, Barrier islands, Currents, Resources development, Alaska, *Outer Continental Shelf, Beaufort Sea, Simpson Lagoon, Epibenthic community, Nearshore currents, Environmental impact, Petroleum development.

Invertebrate investigations in the Simpson Lagoon area on the Alaskan Beaufort Sea Coast concentrated on those organisms identified as important food items to higher trophic levels (fish and birds). The main objectives of the research were to study the seasonal and habitat distributions, abundances and biomasses, and life histories of these important organisms. A potential cause of adverse impacts to epibenthic invertebrates is the construction of causeways or other structures that would block important movements of these invertebrates. The movements that appear important to some of the species include those between the lagoon and off-

shore. Another potential disturbance related to petroleum development on the continental shelf is contaminant (e.g., oil) introductions. Adverse impacts of oil on invertebrates might indirectly affect the fish and birds that depend on those invertebrates for food. Previous investigations have shown that responses of epibenthic invertebrates to oil are highly variable, but that adverse effects occur under some circumstances. In the nearshore environment, invertebrates could be affected by oil in the water column or (probably more critical to epibenthos) by oil on and in benthic substrates. (Sinha-OEIS)
W80-04958

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. OCEANOGRAPHIC AND GEOLOGIC PROCESSES--A SYNTHESIS OF ECOLOGICALLY IMPORTANT INFORMATION,
LGL Ltd-U.S., Inc., Grand Junction, CO.
J. C. Truett.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 601-664, October 1979. 2 Fig, 102 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35193.

Descriptors: *Geomorphology, *Resources development, *Water circulation, Geology, Baseline studies, Alaska, Transport, Environmental effects, Water pollution effects, *Outer Continental Shelf, Beaufort Sea, Coastal processes, Petroleum development, Ecological crises.

This report synthesizes and interprets, from reports of Barrier Island-Lagoon Program participants and from the general literature, data about selected oceanographic and geologic processes in coastal regions. Processes discussed are water circulation and exchange; detritus sources, transport mechanisms and sinks; and the origin and evolution of coastal landforms. The purpose of the synthesis is to provide a more realistic assessment of the ecological consequences of man's alteration of these processes in the Beaufort Sea. The processes investigated are those which strongly influence populations of selected key species of animals in the coastal environment and those affected by oil and gas exploration and development activities on the continental shelf. (Sinha-OEIS)
W80-04959

OBSTACLES TO GEOTHERMAL DEVELOPMENT,
S. P. Budiansky.
Environmental Science and Technology, Vol 14, No 3, p 255-257, March, 1980. 1 Fig.

Descriptors: *Geothermal studies, *Legal aspects, *Financial feasibility, *Environmental effects, Ground water, Water pollution, Land subsidence, Water table, Air pollution, Hydrogen sulfide, Water law.

Legal, financial, and environmental problems associated with geothermal development are minor compared with problems associated with the development of other energy resources. However, these problems must be solved if delays are to be avoided. Direct use of geothermal energy, unlike high-temperature applications, does not cause air pollution but can result in water pollution. The use of injection wells can minimize ground water pollution, water table lowering and land subsidence. The deterioration of ground water quality surrounding an injection well over a 30 year period has been simulated by researchers at EG and G Idaho. Direct use applications are also faced with laws and regulations which were based on the concept of high-temperature, electric-generating, and revenue producing resources. These laws do not apply to low-temperature resources. With some modification, existing water law can provide the basis for direct use development. For example, geoheating would be classified as 'reasonable use' of water resources, and appropriate rights over the entire volume of the resource should not be required for closed systems which return the water they use. (Purdin-NWWA)
W80-04983

THE SIGNIFICANCE OF VITAMINS AND THE EPIPHYTIC BACTERIAL COMMUNITY IN THE NUTRITIONAL ECOLOGY OF CLADOPHORA GLOMERATA,
Wisconsin Univ.-Madison. Dept. of Botany.
J. P. Hoffmann, and G. C. Gerloff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182793, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Completion Report WIS WRC 80-07, 1980. 24 p, 8 Fig, 6 Tab, 40 Ref. OWRT A-074-WIS(1), 14-34-0001-7105; 14-34-0001-7106; 14-34-0001-8053.

Descriptors: *Vitamin B, *Chlorophyta, *Algae, *Nuisance algae, *Bacteria, *Growth rates, Analytical techniques, Statistical methods, Effects, Temperature, Light intensity, Photoperiodism, Nutrients.

The effects of vitamin B1, vitamin B12, temperature, light intensity and photoperiod on growth and zoosporogenesis were investibated by factorial experiments. Statistical analysis showed all effects to be significant as well as some of the interaction terms. Zoosporogenesis was more sensitive to vitamin limitation than was dry weight production. Growth and dry weight production exhibited significantly different optima. Growth was most strongly influenced by temperature whereas photoperiod exerted the strongest influence on zoosporogenesis. Due to the experimental design it was possible to separate the light intensity and photoperiod effects and analysis showed photoperiod to have a primary influence on zoosporogenesis. An 8:16 short day photoperiod elects the greatest number of zoosporangia.
W80-05008

AGRICULTURAL LAND USE: EFFECTS ON THE CHEMICAL QUALITY OF RUNOFF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W80-05012

PHYTOPLANKTON AND ENVIRONMENTAL CONDITIONS IN CENTRAL AND COASTAL AREAS OF THE BOTHNIAN BAY,
Oulu Univ. (Finland). Perameri Research Station.
E. Alasaarela.
Annales Botanici Fennici, Vol 16, No 3, p 241-274, 1979. 23 Fig, 4 Tab, 136 Ref, 1 Append.

Descriptors: *Basic data collections, *Phytoplankton, *Nutrients, *Bothnian Bay(Finland), *Primary productivity, Sampling, Salinity, Temperature, Hydrogen ion concentration, Phosphorus, Phosphate, Iron, Nitrogen, Nitrates, Color, Chlorophyll, Biomass, Diurnal distribution, Algae, Hydrography, Chlorophyta, Coastal waters, Dinoflagellates, Diatoms, Chrysophyta, Cryptophyta, Cyanophyta, Surveys, Finland, Baltic Sea.

The seasonal variation of phytoplankton production, biomass and species composition, and the environmental factors regulating them in the Bothnian Bay, Baltic Sea, were studied in 1976 and 1977 as part of the basic biological survey made of the coastal waters off Oulu, Finland. The outermost sampling stations represent the open waters of Bothnian Bay, while the coastal area is influenced by river waters polluted by industrial and domestic sewage. Results showed that in summer, the surface salinity was 1-3% in the coastal waters and 3.0-3.2% in the open sea. In April, when incident radiation was high, a relatively dense phytoplankton community developed under the ice in both areas. In summer, phytoplankton production showed two peaks in the coastal waters, which were not clearly discerned in the open sea where the primary production and phytoplankton biomass were low. In the open sea, phosphate was very scarce but nitrate was fairly abundant. The phosphate concentration was notably higher in the coastal waters, but nitrate was depleted by the early summer phytoplankton maximum. Hydrography and nutrients considered were temperature, salinity, pH, transparency, iron, phosphorus, nitrogen, and total nitrogen to total phosphorus ratio. Chlorophyll-a, total phytoplankton biomass, daily and annual primary production, thickness of the euphotic layer, intensity and diurnal variation of primary production and important phytoplankton groups and species were also reported. (Luedtke-Wisconsin)
W80-05020

LIGHT INDEPENDENT CARBON FIXATION BY MARINE MACROALGAE,
Cologne Univ. (Germany, F.R.). Botanisches Inst.
B. P. Kremer.
Journal of Phycology, Vol 15, No 3, p 244-247, September 1979. 3 Tab, 13 Ref.

Descriptors: *Marine algae, *Carbon cycle, *Intertidal areas, *Kelps, *Photosynthesis, Marine microorganisms, Carbon fixation, Chlorophyta, Rhodophyta, Phaeophyta, Carboxylation, Dark carbon fixation, Carboxylating enzymes.

Several marine macroalgae representative of Chlorophyceae, Rhodophyceae, and Phaeophyceae were investigated for their potentials of photosynthesis and light independent (dark) carbon fixation. Photosynthesis rates, expressed as net carbon assimilation on a dry weight basis, were of the same order of magnitude in all algal classes. The amounts of photosynthetically fixed carbon on thallus surfaces ranged between 30 and 80 micromol C02/sq dm/hour, and were comparable to the photosynthetic capacities of average terestrial plants. Phaeophyceae achieved considerable rates of light independent carbon fixation, which exceeded photosynthetic rates by 4-5%. In contrast to the species of Chlorophyceae and Rhodophyceae examined, Phaeophyceae showed high activities of phosphoenolpyruvate carboxykinase (PEP-CK) in absolute terms and relative to ribulose-1,5-bisphosphate carboxylase (RubP-C). The composition of the soluble fraction after dark fixation of 14C02 was different from that after photosynthetic carbon assimilation. The neutral fraction of soluble carbohydrates and of organic phosphates accounted for less than 3% of the total C14-labelled assimilates were amino acids (aspartate, glutamate, alanine, and glutamine) and intermediates of the tricarboxylic acid cycle. Asparate, alanine, and citrate constituted the most strongly C14-labelled compounds in the Phaeophyceae, while citrate, although less strongly C14-labelled, was significant in the Rhodophyceae. (Harris-Wisconsin)
W80-05021

SHORT-TERM RESPONSES OF NUTRIENT-DEFICIENT ALGAE TO NUTRIENT ADDITION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5A.
W80-05022

CHLORIDE UPTAKE BY ANACYSTIS NIDULANS (CYANOPHYCEAE),
Queen's Univ., Kingston (Ontario). Dept. of Biology.
S. R. Craig, and K. Budd.
Journal of Phycology, Vol 15, No 3, p 300-304, September 1979. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Chlorides, *Cyanophyta, *Cytological studies, *Nutrient transport, *Photosynthesis, *Metabolism, Kinetics, Algae, Anacystic, Light, Darkness, Biochemistry, Respiration, Inhibitors, Cultures, Tracers, Nutrients, Nutrient requirements, Bacteria, Energy.

Results of experiments investigating chloride uptake by cyanobacteria Anacystis nidulans show that light enhances chloride uptake; therefore, chloride uptake is active with ATP as the most likely energy source. Anacystis nidulans, grown in batch culture with 0.5% C02 in air, was supplied with chloride labelled with C1-36 in light and darkness. Chloride in cells reaches a maximum after 30-50 min at 25C. At this point, internal C1-concentrations are 60-fold external (0.1 mM) con-

centrations in light, 37-fold external concentrations in darkness. Relationships of Cl- uptake to metabolism were investigated using DCMU and DCCD inhibitors and CCCP uncoupling agent. DCMU immediately stops oxygen evolution in light. CCCP has no detectable influence on photosynthesis or dark respiration below 1 microM; above this concentration photosynthesis is progressively inhibited whereas dark respiration is stimulated. DCCD, an energy-transfer inhibitor, progressively inhibits photosynthesis as time and concentration increase; however, dark respiration is unaffected or even stimulated. With DCMU at 10 micro M, light stimulation of Cl- uptake occurs. CCCP strongly inhibits Cl- uptake in light and darkness. DCCD has no effect on dark Cl- uptake and inhibits light Cl- uptake more slowly than photosynthesis. (Danovich-Wisconsin)
W80-05023

PHOSPHATE-LIMITED GROWTH KINETICS OF SELENASTRUM CAPRICORNUTUM (CHLOROPHYCEAE),
Alaska Univ., Fairbanks. Inst. of Water Resources.
E. J. Brown, and D. K. Button.
Journal of Phycology, Vol 15, No 3, p 305-311, September 1979. 4 Fig, 1 Tab, 35 Ref. NSF DEB77-08427.

Descriptors: *Phosphates, *Growth rates, *Kinetics, *Orthophosphate, *Selenastrum, Chlorophyta, Cultures, Nutrients, Limiting factors, Cytological studies, Metabolism, Speciation, Nutrient requirements, Monod equation, Michaelis-Menton equations, Phytoplankton, Algae, Phosphates.

Steady-state phosphate-limited growth kinetics of Selenastrum capricornutum were examined using continuous cultures to characterize the green alga's ability to compete for orthophosphate (OP) when OP limits growth. Comparable data obtained for aquatic yeast Rhosdotorula rubra and similar data for diatom Asterionella formosa indicate that both the heterotrophic yeast and the diatom have a competitive growth advantage over Selenastrum in OP-limited steady-state systems. Thus for Selenastrum to predominate in a mixed species environment truly limited by phosphorus, factors other than steady-state OP-limited growth must regulate total biomass production. Selenastrum maximum specific growth rate at 20C is 1.20/d, and the concentration where half maximal growth rate occurs is 40 nM OP. An apparent external phosphate threshold occurs at 10 nM OP, below which net phosphate is zero. Cell yields vary inversely with growth rate; thus ability to utilize OP can not be characterized in terms of Monod half-saturation constant and maximal growth rate. Instead, OP affinity is calculated from steady-state flux vs external OP concentrations. The steady-state flux derived phosphate affinity of this aquatic organism is relatively low, 2.8 l/mg dwt d. These experiments provide kinetic evidence against theoretical phytoplankton growth studies which assume that relative nutrient utilization abilities regulate species composition. (Danovich-Wisconsin)
W80-05024

A CONSIDERATION OF TROPHIC DYNAMICS IN SOME TALLGRASS PRAIRIE FARM PONDS,
Kansas State Univ., Manhattan. Div. of Biology.
J. A. Arruda.
The American Midland Naturalist, Vol 102, No 2, p 254-262, October 1979. 2 Fig, 3 Tab, 23 Ref.

Descriptors: *Primary productivity, *Predation, *Farm ponds, *Ecosystems, *Kansas, *Food chains, *Food pyramids, Biomass, Trophic level, Variability, Population dynamics, Ecotypes, Size, Aquatic insects, Aquatic populations, Biological communities, Balance of nature, Secondary productivity, Food abundance, Standing crops, Diptera, Grasslands.

Data from five farm ponds in Kansas, sampled in summer 1975, supported Fretwell's construct that some ecosystem patterns are explained by interactions between primary productivity and predation. While these two factors do not completely regulate these farm pond ecosystems, they account for some of the observed variation. The biological null hypothesis that no relationship exists between biomasses of the ponds' trophic levels and their primary production is rejected. Biomass increases by both primary and tertiary consumers, the food-limited levels, and decreases by both secondary consumers and littoral producers, the predator-limited levels, is consistent with Fretwell's construct. As primary production increases and organic matter is incorporated into higher trophic levels, the abundance of the top predator increases. Abundance of the predator-limited trophic level below it decreases because its predator is more abundant. The next trophic level below increases due to lower predation. Patterns in body size of two major consumers, damselfly naiads and chironomid larvae, are strongly corroborative of Fretwell's construct. Along with decline in biomass, damselfly naiads' mean body size decreases. The opposite is true for midge larvae; they are larger where biomass increased and individual numbers decreased. These latter results occur when predator pressure decreases and competitive interactions in the new food-limited environment are more severe. Data are suggestive of patterns in ecosystem structure: patterns mediated by interactions between energy available to consumers and predation intensity. (Danovich-Wisconsin)
W80-05025

EFFECT OF NITRIFICATION IN ORTA LAKE,
Consiglio Nazionale delle Ricerhe, Milan (Italy).
M. Gerletti, and A. Provini.
Progress in Water Technology, Vol 10, No 6, p 839-851, 1978. 5 Fig, 5 Tab, 17 Ref.

Descriptors: *Nitrification, *Orta Lake, Italy, *Water chemistry, *Industrial wastes, *Hydrogen ion concentration, *Water pollution effects, Denitrification, Ammonia, Dissolved oxygen, Nitrates, Nitrites, Copper, Hypolimnion, Epilimnion, Ions, Seasonal, Hydrologic aspects, Chemical properties, Stratification, Alkalinity.

Lake Orta, Italy, subjected to industrial wastewaters from cuproammonia rayon factory since 1927, has a 1975 mean nitrification rate of 3-5 micro g N/l d because nitrification inhibiting substances are absent. Lake waters average 11 mg/l total inorganic nitrogen. Lake Orta has 18.1 sq km surface area, 143 m maximum depth and 71 m mean depth. Original natural alkalinity should have ranged 7-12 mg CaC03/l in relation to its granitic drainage basin; however, Orta has probably been acidic for 30 years. Ionic composition of lake waters gradually changed from a soft bicarbonate to a unique sulfate-nitrate-ammonia type with pH fluctuations governed by excess ammonia or nitric ions. Hypolimnion pH values are annually constant near 4; epilimnion pH values are low during winter and increase to 9 spring to autumn. Hypolimnetic temperature and pH do not vary significantly during the year; consequently nitrification is constant, although it is slow. Denitrification may occur in deep hypolimnion layers at the end of thermal stratification when oxygen concentrations are low. During spring to autumn 459-711 tons of ammonia are lost in the hypolimnion while nitrates increased slightly. During this time, nitrites are not important. Denitrification processes probably cause the observed changes. (Danovich-Wisconsin)
W80-05026

SEASONAL VARIATION OF DENITRIFICATION RATE IN SEDIMENT DETERMINED BY USE OF N15,
Danish Isotope Center, Copenhagen.
P. P. Madsen.
Water Research, Vol 13, No 5, p 461-465, 1979. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Seasonal, *Denitrification, *Tracers, *Arreso Lake, Denmark, *Lake sediments, *Laboratory tests, Sediments, Gases, Nitrogen, Nitrates, Analytical techniques, Methodology, Spectrometers, Isotope studies, Ammonia, Organic compounds, Nitrogen cycle.

Based on annual measured-rate constants and nitrate concentrations, approximately 10% of the total nitrogen loading of Lake Arreso, Denmark, is denitrified. Measurements performed March-November 1977 on Lake Arreso sediments indicate first-order kinetics of denitrification with respect to nitrate concentration; the first-order rate constant (KD) varies 0.4-40 micro sec. KD seasonal changes are due to variations in organic matter availability. Variations in oxidizable organic matter correlate to algae growth and sedimentation during the year. Maximum KD values occur in August coinciding with maximum sediment oxygen consumption. First-order nitrate reduction rate constant, KA, ranges 2-8 micro sec. An estimated 1.3 g N/sq m yr is denitrified; results are reasonable compared with a total 10-15 g N/sq m yr nitrogen loading. Arreso is a shallow, unstratified lake situated north of Copenhagen; it has a 41 sq km area and 7 m maximum depth. Determinations of nitrogen gas evolved from N15-labelled nitrate is based on isotope dilution. Gas evolved is spiked with unlabelled dinitrogen; N15-enrichment of the resulting gas mixture is measured by optical spectrometry. The method allows simultaneous measurements of nitrate reduced to ammonia and organic nitrogen. (Danovich-Wisconsin)
W80-05027

PHOSPHORUS LOADING FROM URBAN STORMWATER RUNOFF AS A FACTOR IN LAKE EUTROPHICATION: I. THEORETICAL CONSIDERATIONS AND QUALITATIVE ASPECTS,
Wisconsin Univ. Madison. Dept. of Soil Science.
M. G. Browman, R. F. Harris, J. C. Ryden, and J. K. Syers.
Journal of Environmental Quality, Vol 8, No 4, p 561-566, October-December 1979. 1 Fig, 4 Tab, 33 Ref. NSF AG-199, 40-193-69.

Descriptors: *Phosphorus, *Urban runoff, *Lake Wingra(WI), *Storm runoff, Theoretical analysis, Phosphorus compounds, Inflow, Runoff, Organic compounds, Leaves, Orthophosphate, Hydrographs, Sampling, Settling velocity, Seasonal, Flow, Flow profiles, Flow rates, Nutrients, Nutrient loading.

Theoretical fractionation of urban phosphorus (P) runoff reveals that for major loading phases of runoff events, a significant proportion (35-50%) of particulate P commonly remains in suspension in the photic zone for several days, interacting with lake water and biological components. Urban P runoff from two separate storm sewer systems draining residential areas in the Lake Wingra Basin, Madison, Wisconsin, were monitored fall 1971-summer 1972. In general, the highest total dissolved P levels are obtained in fall and spring runoff, coinciding with leaf fall and elm fruit fall, respectively. Dissolved inorganic P constitutes at least 79% and often > 90% of total dissolved P, indicating that almost all dissolved P in this runoff is directly available for algal uptake subject to other conditions such as light and temperature. Flow-weighted mean concentrations of total particulate P ranges 0.14-2.37 mg P/l; for dissolved inorganic P concentrations are 0.10-2.11 mg/l for individual runoff events. For all flow periods, a major portion of the total particulate P comprises particles that settle very slowly (<0.1 cm/min); in low-flow periods 74%-80% fall into this class. These particles are likely to remain in the photic zone for several days. Particles settling at >1 cm/min provide significant portions (18%-34%) of total particulate P during initial flush and highflow periods, but contribute nothing to the subsequent low-flow period. (Danovich-Wisconsin)
W80-05029

SEASONAL VARIATION OF PSYCHROTROPHIC BACTERIA IN SEDIMENT FROM LAKE ONTARIO,
Waterloo Univ. (Ontario). Dept. of Biology.
W. E. Inniss, and C. I. Mayfield.
Water Research, Vol 13, No 6, p 481-484, 1979. 3 Tab, 18 Ref.

Descriptors: *Seasonal, *Bay of Quinte, Lake Ontario, *Bacteria, *Sediments, *Water temperature, Great Lakes, Lake sediments, Population dynamics, Growth rates, Population, Speciation, Biomass, Cultures, Temporal distribution, Heated water,

Pseudomonas, Flavobacterium, Chromobacterium, Sampling, Sediment-water interfaces.

Regardless of season, all sediment samples collected from the Bay of Quinte, Lake Ontario, July and November 1977 and February and May 1978, contain large psychrotropic bacterial populations. Sediment temperature range is 18.8C, 4C, 4C and 5C in July, November, February and May, respectively. Sediments with lower insitu temperatures have higher numbers of viable bacteria. Sediment temperature affects not only bacteria numbers but also population composition. November, February and May samples contain a greater percentage of chromogenic bacteria than the July sample. Bacteria isolated from any given sample and incubated at 20C give equal or higher numbers than sediments incubated at 0C. Almost all bacteria isolated at 0C in July also grow at 20C; even in February and May samples, 90% of the population isolated at 0C grows at 20C. Only 73% of the bacteria isolated at 20C in July grows at 0C, with higher percentages in November, February and May sediment samples. Pseudomonas dominates in July samples at both 0C and 20C isolation temperatures, whereas Flavobacterium prevails in November, February and May samples. Pseudomonas and Flavobacterium are the most frequently isolated genera. Chromobacterium is found in relatively low numbers in November, February and May samples. Diversity is higher in colder sediments; the July sample has the lowest population diversity. (Danovich-Wisconsin)
W80-05030

EFFECTS OF HYPOLIMNETIC AERATION ON NITROGEN TRANSFORMATIONS IN SIMULATED LAKE SEDIMENT-WATER SYSTEMS,
Wisconsin Univ. Madison. Dept. of Soil Sciences.
R. L. Chen, D. R. Keeney, and L. J. Sikora.
Journal of Environmental Quality, Vol 8, No 3, p 429-433, July-September 1979. 4 Fig, 4 Tab, 18 Ref. EPA R-802692-01-0.

Descriptors: *Nitrogen cycle, *Lake restoration, *Aeration, *Cox Hollow Lake(WI), *Oxidation-reduction potential, Lakes, Nitrogen, Eutrophication, Anaerobic conditions, Cycling nutrients, Nitrification, Denitrification, Sediment-water interfaces, Laboratory tests, Chemical analysis, Nitrates, Nitrites, Ammonia, Hypolimnion.

Laboratory tests of nitrogen (N) transformations on lake water and sediment samples obtained from Cox Hollow Lake, a southwestern Wisconsin recreational impoundment, occurs soon after hypolimnion aeration. Therefore, hypolimnion aeration is not an effective way to remove N from lakes. However, shortly after nitrification occurs in aerated lakes, the rate of nitrare formation is limited by ammonia depletion. Nitrates are subject to several reactions; some interact with the diffuse sediment-water interface where they encounter a highly reduced environment. In Cox Hollow sediment, 60-65% of the nitrates are immobilized to ammonia and organic N. Hence, although nitrates disappear from the hypolimnion during aeration, a large net N loss does not occur. Other studies show that Lake Mendota sediments immobilize 30% and Green Bay sediments (WI), 10% of the nitrates added. Larger net N losses by denitrification are expected if aeration is discontinued at maximum nitrate accumulation, which occurs two weeks after initial aeration in these experiments. Cox Hollow Lake has 8.8 m maximum depth and loses its dissolved oxygen below 2 m during summer stratification. Samples were collected at 8.5 m in July 1975. (Danovich-Wisconsin)
W80-05031

CELLULOSE PRODUCTION BY PLANKTONIC ALGAE IN LACUSTRINE ENVIRONMENTS,
Massachusetts Univ. Amherst. Dept. of Environmental Sciences.
J. Rho, and W. Litsky.
Hydrobiologia, Vol 66, No 3, p 249-258, October 1979. 3 Fig, 6 Tab, 21 Ref.

Descriptors: *Phytoplankton, *Carbohydrates, *Cellulose, *Lentic environment, *Lakes, Eutrophication, Farm ponds, Oligotrophy, Photosynthesis, Organic matter, Chlorophyta, Cyanophyta, Primary productivity, Quabbin Reservoir, Massachusetts, Decomposing organic matter, Degradation(Decomposition), Seasonal, Algae, Speciation.

Cellulose production by planktonic algae in an eutrophic pond (Amherst, Massachusetts) and in an oligotrophic lake (Quabbin Reservoir, Massachusetts) indicates that algal cellulose production exceeds decomposition and cellulose remains in the water column for long time periods. Absorption spectra of C-fractions extracted from algal cells indicate that algae are the major cellulose contributors of particulate matter. In both the lake and pond, various Chlorophyceae are the most common algal cellulose producers. Cellulose content of dominant algal cellulose producers ranges 2%-39% of total dry weight, depending on algal species and growth phase. Amounts of cellulose present in the water column range 4%-50% of total particulate matter dry weight. Cellulose contents are higher in the eutrophic system than in the oligotrophic system, probably due to presence of larger phytoplanktonic crops in the eutrophic system. During summer months, when algal populations reach maximum, particulate matter cellulose content ranges 8%-31%. During winter and spring, when algal populations are low, the cellulose percentage in water column varies 0.1%-2%. More cellulose is present in the water column than is accounted for by the number of algal cells observed. Differences are due to cellulose accumulation from previous algal crops. (Harris-Wisconsin)
W80-05032

SPECIATION AND RATE OF LOSS OF COPPER FROM LAKEWATER WITH IMPLICATIONS TO TOXICITY,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. Wagemann, and J. Barica.
Water Research, Vol 13, No 6, p 515-523, 1979. 4 Fig, 6 Tab, 39 Ref.

Descriptors: *Copper, *Toxicity, *Manitoba, Canada, *Algicides, *Chemical reactions, Algae, Algal control, Algal poisoning, Algal toxins, Water chemistry, Hydrogen ion concentration, Lakes, Copper compounds, Copper sulfate, Inorganic compounds, Copper sulfate, Kinetics, Equilibrium, Biochemistry, Cyanophyta.

Copper effectiveness as an algicide in lakes in southwest Manitoba depends upon the total toxic copper concentration, which is equal to the sum of three species ($Cu+2$, $CuOH+$, $Cu(OH)0$ sub 2). Total toxic copper explains the unexpectedly high effectiveness of copper as an algicide in aquatic systems with relatively high pH. Total toxic copper is larger in the six prairie, pothole, hard-water lakes, at any time, than cupric ion concentration alone by a factor 320-7400, depending on the lake. This is mainly due to relatively high pH in these lakes; at $pH > 8$, total toxic copper is essentially all $Cu(OH)0$ sub 2. Free cupric ion concentrations ($<0.5\%$ total dissolved copper) are also low due to high organic matter concentrations. For all lakes but one, first-order rate constants for total dissolved copper (TDCu) disappearance from water column ranges 0.47-1.01/d and corresponding half-time ranges 1-2 d. The rate constant for the other lake is 0.11/d and corresponding half-time 7 d. This lake differs chemically from the other lakes and is not typical of the area since it is large and has intermittent outflow and sandy sediments. Other lakes are small and shallow, have no permanent inlet or outlet, and have heavy clay sediments. A nearly constant, steady-state concentration is attained in all lakes 10 days after copper sulfate is added. Precipitation of tenorite, malachite and azurite substantially reduces TDCu concentrations. Physical adsorption of copper onto sediments and seston activity also reduce TDCu concentrations. (Danovich-Wisconsin)
W80-05034

EFFECTS OF TWO AROCLOR FRACTIONS ON THE PRODUCTIVITY AND DIVERSITY OF ALGAE FROM TWO LENTIC ECOSYSTEMS,
Wheaton Coll., Norton, MA. Dept. of Biology.
J. C. Kricher, C. L. Bayer, and D. A. Martin.
International Journal of Environmental Studies, Vol 13, No 2, p 159-167, 1979. 10 Tab, 23 Ref.

Descriptors: *Aroclors, *Polychlorinated biphenyls, *Algae, *Water pollution effects, *Stony Brook Pond(MA), *Norton Reservoir(MA), Phytoplankton, Water pollution, Pollutants, Primary productivity, Laboratory tests, Cultures, Speciation, Tracers, Biochemistry, Diatoms, Cyanophyta, Chlorophyta, Lentic envirnment, Growth rates, Massachusetts.

In algal communities in Norton Reservoir and Stony Brook Pond, located 22.5 km apart in southeastern Massachusetts, polychlorinated biphenyl (PCB) Aroclor 1232 is more severe in its effects than Aroclor 1254. During summer 1976, algal communities from these lakes were exposed in laboratory cultures to Aroclor, the only PCB manufactured in the U.S. Both lakes have quite distinct algal communities: Norton Reservoir is characterized by large numbers of Cyanophyceae species whereas Stony Brook Pond is dominated by Bacillariophyceae and Chlorophyceae. Although algal communities are different, both respond similarly to laboratory PCB exposures. Carbon fixation rates following a 24 hr exposure to 1 ppm Aroclor 1232 and 1 ppm 1254 are greatly reduced compared with both untreated and 0.1% acetone controls. Productivity depression is significantly greater in the Aroclor 1232 series than in 1254. Treatment with 100 ppb 1232 also reduces productivity in both ecosystems but not nearly to the degree that 1 ppm does. Lethal PCB effects are inversely related to chlorine content. Algal communities differ in the extent of productivity depression incurred by acetone. Norton 0.1% acetone controls decrease C14 uptake by 23.4% compared with untreated controls whereas only an 11% decrease is observed for Stony Brook. Algal response results from a differential effect of acetone on Cyanophyte physiology. Another difference occurs when Aroclor 1254 at 100 ppb increases C14 uptake compared with acetone controls in Norton cultures, whereas in Stony Brook, ppb 1254 decreases productivity 23% compared with the acetone series. (Danovich-Wisconsin)
W80-05035

THE RESPONSE OF BENTHIC PLANTS TO PAST LEVELS OF HUMAN USE IN HIGH MOUNTAIN LAKES IN KINGS CANYON NATIONAL PARK, CALIFORNIA, U.S.A.,
California Univ., Berkeley. Dept. of Forestry and Conservation.
T. P. Taylor, and D. C. Erman.
Journal of Environmental Management, Vol 9, No 3, p 271-278, November 1979. 2 Fig, 2 Tab, 30 Ref.

Descriptors: *Kings Canyon National Park(CA), *Nitrates, *Benthic flora, *Recreation wastes, *Water pollution effects, Lakes, Recreation, Iron, Rooted aquatic plants, Alpine, Elevation, Mountains, Recreation demand, Nutrients, Algae, Oligotrophy, Cycling nutrients, Nutrient loading, Macrophytes.

Observations of bottom flora in August 1977 showed that rooted aquatic plants have increased in remote high elevation lakes in Kings Canyon National Park, California. Unrestricted human recreational activities in these lakes during the 1950s and 1960s probably produced large nutrient inputs which are still stimulating present benthic flora growth. Rooted macrophytes (Isoetes, Anacharis, Nitella) as well as bottom algae (Rhizoclonium) cover more of the bottom on lakes with historically higher human use levels. Historic human use contributes nutrients which slowly accumulate in lake sediments. As a result, lakes with more nutrients produce an increased abundance of bottom flora, have lower nitrate concentrations in the water column because of uptake by rooted plants, and have higher total iron concentrations. Mean nitrate concentrations range 0-156 micro g/l with East Kearsarge, Upper Sixty and Upper Rae having high concentrations. Mean total iron concentrations range 4-36 micro g/l with Upper Kear-

sarge having the highest concentration. Mean benthic flora frequencies range 0-100%. Upper Kearsarge, Lower Rae and Bullfrog have high rooted aquatic plant abundance whereas in East Kearsarge and Upper Sixty Lakes, no plants are encountered. East Kearsarge, Lower Sixty and Upper Sixty lakes have low human impact values, while Bullfrog, Charlotte and Lower Rae lakes have exceptionally high values. (Danovich-Wisconsin)
W80-05036

THE UPTAKE OF CHEMICAL ELEMENTS FROM COAL ASH AND SETTLING BASIN EFFLUENT BY PRIMARY PRODUCERS I. RELATIVE CONCENTRATIONS IN PREDOMINANT PLANTS,
Texas Univ. Health Science Center at Houston. School of Public Health.
R. K. Guthrie, and D. S. Cherry.
The Science of the Total Environment, Vol 12, No 3, p 217-222, August 1979. 2 Tab, 15 Ref. AEC AT(38-1)824.

Descriptors: *Rooted aquatic plants, *Chemicals, *Fly ash, *Bioaccumulation, *Savannah River Project(SC), Macrophytes, Biochemistry, Coals, Electric powerplants, Electric power production, Heavy metals, Toxicity, Cattails, Cyanophyta, Water chemistry, Sediments, Water pollution effects, Neutron activation analysis.

Chemical analysis of predominant plants in the ash settling basin drainage system of the Savannah River Project, Aiken, South Carolina, January-December 1974, revealed that the aquatic producers which bioaccumulate chemicals released in coal ash effluents are important and efficient chemical removal mechanisms. Duckweed (Lemna perpusilla) predominates throughout the year; other producers include cattail (Typha latifolia), Pontederia, bald cypress (Taxodium distichum) and algae (Oscillatoria and Hydrodictyon). Mean annual chemical concentrations are highest in sediments and lowest in water for the entire drainage system. Some exceptions are Mn (highest in cattail, 425 ppm), Cl (higher in all plants except Hydrodictyon), Cd (highest in cattail, 1.9 ppm; lowest in cypress, 0.05 ppm), Br (higher in all plants), Sb (highest in Oscillatoria, 2.4 ppm), and Hg (highest in Oscillatoria, 0.9 ppm; lowest in cypress, 0.005 ppm). Of potential macronutrients Fe, Ca, K and Mg, Fe is most highly concentrated by Hydrodictyon and duckweed; Ca by cattail; K by Pontederia and cattail; and Mg by cattail and duckweed. Cu and Zn concentrations are highest in Oscillatoria and lowest in cypress. Cypress leaves accumulate least amounts of the elements measured and do not concentrate any element to the greatest extent. The Savannah River Project power plant burns 451,940 metric tons coal/yr and produces 32,650 metric tons ash which is sluiced into a settling basin by 4.9 billion l water. (Danovich-Wisconsin)
W80-05038

EFFECT OF CYSTEINE AND METHIONINE ON SULFATE UPTAKE AND PRIMARY PRODUCTIVITY BY AXENIC CULTURES AND LAKE MICROPLANKTON COMMUNITIES,
New York State Museum, Albany.
R. H. Monheimer.
Journal of Phycology, Vol 15, No 3, p 284-288, September 1979. 3 Fig, 18 Ref. NSF DEB 76-10591.

Descriptors: *Sulfates, *Kinetics, *Primary productivity, *Phytoplankton, *Organic compounds, *Metabolism, Algae, Anabaena, Nannoplankton, Sulfur, Navicula, Ankistrodesmus, Speciation, Cultures, Biological communities, Water pollution effects, On-site tests, Lake George(NY), Tracers, Canadarago Lake(NY), Plant physiology, New York.

Culture and in-situ experiments (April-October 1976) examining effects of organic sulfur (S) on sulfate uptake by algae and naturally occurring microplankton communities concluded that algal sulfate uptake and primary productivity will probably not be influenced by dissolved organic matter additions to waters. In most fresh water systems, organic S pollution effects on algal sulfate uptake and primary productivity are insignificant when compared to other ecological changes which overshadow any such effects. Equimolar mixtures of cysteine and methionine (organic S) in 500 microg S/1 concentrations have no effects on Navicula pelliculosa sulfate uptake rates. However, this mixture decreases sulfate uptake rates of Ankistrodesmus falcatus; uptake rates of Anabaena flos-aquae are decreased by 50 microg organic S/1. In these axenic cultures, primary productivity also decreases in A. falcatus. In situ isotope uptake experiments took place in oligotrophic Lake George and eutrophic Canadarago Lake, New York. Effects of organic S additions on sulfate uptake and primary productivity are in basic agreement with, but less pronounced than, parallel effects on algal cultures. Sulfate uptake rates, relative to primary productivity, are higher when diatoms and blue-green algae are present; and lower when green algae are present. Additions of cysteine/methionine mixtures to lake waters decrease microplankton sulfate uptake rates in correlation with algal community composition. Primary productivity decreases upon cysteine/methionine additions when green algae are relatively abundant. (Danovich-Wisconsin)
W80-05039

LAKE ECOSYSTEMS: A POLYHEDRAL DYNAMICS REPRESENTATION,
New York Univ., NY. Dept. of Computer Applications and Information Systems.
J. Casti, J. Kempf, L. Duckstein, and M. Fogel.
Ecological Modelling, Vol 7, No 3, p 223-237, September 1979. 3 Fig, 4 Tab, 13 Ref. NSF ENG 76 20280.

Descriptors: *Polyhedral dynamics, *Lakes, *Methodology, *Eutrophication, Systems analysis, Water quality, Nutrients, Light, Phytoplankton, Zooplankton, Model studies, Q-analysis, Food chains, Ecosystems, Dynamics, Fish, Productivity, Graphical analysis, Equations.

Polyhedral dynamics, a type of systems methodology based on topology, is presented as a technique for modeling the global structure and dynamic behavior of water quality problems in the aquatic ecosystem. The lake ecosystem, composed of organic and inorganic nutrients, light, phytoplankton, zooplankton, and fish is presented as a multidimensional graph using a technique called Q-analysis. Then a flow pattern is superimposed upon the Q-analysis to describe the dynamic behavior of the system. The utility of the method is demonstrated by looking at the effects of eutrophication. Q-analysis results correlate well with the traditional concept of a food chain. Also, the dynamic changes in the ecosystem caused by nutrient addition are seen to be a result of limits on matter and energy flow through the ecosystem imposed by the structure as it is defined by the Q and obstruction vectors. This insight can not be easily reached by traditional differential equation representations. Consideration of the dynamic behavior gives a quantitative basis to the qualitative changes which an ecosystem undergoes as a result of increased nutrient loading. Thus the approach may be used to assess the effectiveness of alternative eutrophication control methods. However, the nonlinear nature of the pattern defined by the analysis makes a more quantitative analysis difficult. (Luedtke-Wisconsin)
W80-05040

SEASONAL DISTRIBUTION AND ABUNDANCE OF MARINE BIRDS IN ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
C. J. Lensink, and P. J. Gould.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 1-6, October 1979. 19 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Data collections, Resources development, Alaska, Seasons, Environmental effects, Water pollution effects, Baseline studies, *Outer Continental Shelf, Petroleum development, Seasonal distribution, Gulf of Alaska, Bering Sea, Beaufort Sea, Chukchi Sea.

Over 10,000 transects have been completed which equates to over 100,000 computer cards or over 1,000,000 pieces of information. This data base contains information derived from shipboard and aerial surveys of birds in all of Alaska's marine habitats. The greatest bulk of data is from the Gulf of Alaska, particularly in the Kodiak region. A substantial amount of data from the Bering Sea and a small amount from the Chukchi and Beaufort Seas is also present. Information on the distribution and abundance of marine birds over the outer continental shelf of Alaska is critical for the establishment of methods for preventing or mitigating impacts associated with the development of petroleum reserves. (Sinha-OEIS)
W80-05041

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05042

THE BREEDING BIOLOGY OF MARINE BIRDS ASSOCIATED WITH CHINIAK BAY, KODIAK ISLAND, 1975-1978,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05043

BREEDING BIOLOGY AND FEEDING HABITS OF SEABIRDS OF SITKALIDAK STRAIT,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05044

THE PELAGIC BIRDS OF TUXEDNI WILDERNESS, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
R. D. Jones, Jr., and M. R. Petersen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 187-232, October 1979. 10 Fig, 8 Tab, 23 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-2538.

Descriptors: *Birds, *Breeding, *Food habits, *Ecology, Environmental effects, Resources development, Water resources, Aircraft, Baseline studies, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development, Disturbances, Noise pollution, Pelagig birds.

A study of seabird colonies on Chisik and Duck Islands comprising the Tuxedni Wilderness in lower Cook Inlet is reported. Productivity statistics concerning black-legged kittiwakes and horned puffins are compiled through their incubation and nestling stages to fledgling. Observations of common murres and glaucous-winged gulls are recorded on a more incidental base. The gulls emerged as an important predator of kittiwakes and murres. The kittiwakes (a surface feeder) failed in the reproductive effort, while the puffins (a diver) achieved success. Both of these species fed on Pacific sand lance, puffins exclusively and kittiwakes nearly so. It is believed kittiwakes failed because this fish did not enter surface wates in substantial numbers, but puffins found them in deeper layers. The kittiwakes have failed in three of four known breeding attempts, which argues a need to continue the studies and to study the fish. Airplanes, particularly helicopters on OCS related activities, create disturbances that expose kittiwake eggs and nestlings to predation by overabundant glaucous-winged gulls. (Sinha-OEIS)

W80-05045

REPRODUCTIVE ECOLOGY OF SEABIRDS AT MIDDLETON ISLAND, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05046

THE WINTER FEEDING HABITS OF SELECTED SPECIES OF MARINE BIRDS IN KACHEMAK BAY, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05047

NEARSHORE FEEDING ECOLOGY OF MARINE BIRDS IN THE KODIAK AREA, 1978,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
L. D. Krasnow, G. A. Sanger, and D. W. Wiswar.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 348-394, October 1979. 16 Fig, 4 Tab, 22 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-2538.

Descriptors: *Birds, *Food habits, *Ecology, *Water pollution effects, Environmental effects, Resources development, Baseline studies, Food chains, Oil spills, Alaska, *Outer Continental Shelf, Kodiak Island, Gulf of Alaska, Petroleum development.

A study of the feeding habits of marine birds in the nearshore waters of the Kodiak Island area was undertaken in order to evaluate the possible impact of OCS activities on their feeding ecology. A total of 58 oldsquaw, black scoters, common murres and marbled murrelets were collected in Chiniak Bay between 23 and 25 February 1978. Their stomachs were examined and aggregate percent volume was calculated for each type of prey. Seabird collections were made between 2 April and 30 August 1978, in the Kodiak area. A total of 555 black-legged kittiwakes, tufted puffins, common murres, sooty and short-tailed shearwaters, marbled murrelets and pigeon guillemots was collected. Of these, 323 (58%) had digestible prey tissue in their stomachs. Offshore Continental Shelf activities which endanger the productivity of benthic invertebrate or epipelagic euphausiid and fish populations could have a significant negative impact on the feeding ecology of marine birds. Most of the seabirds studied are primarily piscivorous, consuming almost entirely capelin, sand lance, pollock and Pacific sandfish during the breeding season. Those which have more diverse diets (pigeon guillemots and wintering oldsquaw and black scoters) are dependent on sessile or slowly moving benthic forms which may be unable to avoid contact with contaminated water. (Sinha-OEIS)
W80-05048

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA AND SOUTHERN BERING SEA. PART 6: POPULATIONS AND ECOLOGY OF SEABIRDS OF THE KONIUJI GROUP, SHUMAGIN ISLANDS, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
R. A. Moe, and R. H. Day.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 395-491, October 1979. 31 Fig, 38 Tab, 28 Ref, Addendum, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Ecology, *Food chains, *Breeding, Monitoring, Baseline studies, Water pollution effects, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Petroleum development, Alaska Peninsula.

This study of marine birds in the Shumagin Islands was one of several site specific studies of birds. The general purpose of the studies was to obtain information on birds necessary to evaluate the potential impacts of the proposed development of petroleum resources of the outer continental shelf and to provide baseline data for monitoring the effects of the development program. The Shumagin Islands were chosen as a study site because of the presence of large, diverse populations of marine birds that could be adversely affected by development in the Kodiak Basin or by tanker traffic from development areas in the Bering, Chukchi, or Beaufort Seas. In addition, the presence of large populations of small alcids was of interest because species in this group are highly vulnerable to marine pollution and were not adequately represented at other study areas. A notable feature of the colony distribution in the Koniuji Group is the concentration of breeding seabirds at the northern end of Big Koniuji and in the Koniuji Strait - Yukon Harbor area at the island's southeastern end. At each of these localities strong winds and tidal rips are prevalent, which are important mechanisms of nutrient-mixing in this greater availability of nutrients, support a large standing crop of euphisiids, which in turn support large seabird populations. (Sinha-OEIS)
W80-05049

POPULATION DYNAMICS AND TROPHIC RELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA AND SOUTHERN BERING SEA. PART 11: NOTES ON THE WINTER SEABIRDS OF CHINIAK BAY, KODIAK ISLAND, ALASKA,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 5B.
W80-05050

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF COOK INLET AND NEGOA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, and A. J. Paul.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 1-30, October 1979. 44 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Benthos, *Baseline studies, *Fisheries, *Water pollution effects, Oil spills, Clams, Crabs, Shrimp, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Gulf of Alaska, Cook Inlet, Petroleum development.

The long-term objectives of this study are: (1) a qualitative and quantitative inventory of benthic species within and adjacent to identified oil-lease sites in the northeast Gulf of Alaska (NEGOA) and lower Cook Inlet, (2) a description of spatial distribution patterns of selected species in the designated study areas, and (3) observations of biological interrelationships, specifically trophic interactions, between components of the benthic biota in designated study areas. Forty-two widely dispersed permanent stations for quantitative grab sampling have been established and these stations represent a reasonable nucleus around which a monitoring program can be developed. Infaunal invertebrates taken by van Veen grab in the northeast Gulf of Alaska have been used to comprehend station/species aggregations by cluster analysis. Preliminary groupings of stations into three basic clusters have been accomplished. The operations connected with oil exploration, production, and transportation in the Gulf of Alaska present a wide spectrum of potential dangers to the marine environment. Adverse effects on the marine environment of these areas cannot be quantitatively assessed, or even predicted, unless background data are recorded prior to industrial development. (Sinha-OEIS)
W80-05052

KEY ORGANISMS IN BENTHIC FOOD WEBS AND THEIR RELATIONSHIP TO IMPORTANT HABITATS IN LOWER COOK INLET,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, and A. J. Paul.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 31-83, October 1979. 4 Fig, 17 Tab, 42 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Benthos, *Habitat, *Food webs, *Ecosystems, Water pollution effects, Monitoring, Baseline studies, Environmental effects, Oil pollution, Resources development, Crabs, Shrimps, Fisheries, Fish, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

The snow crab (Chionoecetes bairdi) is a conspicuous member of the shallow shelf of lower Cook Inlet, and supports a commercial fishery of considerable importance. Food data for snow crab, king crab (Paralithodes camtschatica), Dungeness crab (Cancer magister), 9 species of shrimps, and 19 species of fishes are now available. The importance of deposit-feeding clams in the diet of king and snow crabs, and some bottom fishes is clear. It is suggested that comprehension of the relationship between oil, sediment, deposit-feeding clams, king and snow crabs is essential to understand the potential impact of oil on the latter two commercially important species. Initial assessment of all data suggests that sufficient station uniqueness exists to permit development of monitoring programs based on species composition at selected stations utilizing grab, dredge, and trawl sampling techniques; and adequate numbers of biologically well-known, unique, and/or large species are available to permit nomination of likely monitoring candidates once industrial activity is initiated. Benthic invertebrates (primarily the infauna, and slow-moving epifauna) are useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-range environmental changes and, by their presence, generally reflect the nature of the sub-stratum. (Sinha-OEIS)
W80-05053

DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE AND TROPHIC RELATIONSHIPS OF THE NEARSHORE BENTHOS OF THE KODIAK SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, M. Hoberg, and S. C. Jewett.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 84-207, October 1979. 5 Fig, 27 Tab, 72 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Benthos, *Food webs, *Ecosystems, Water pollution effects, Baseline studies, Monitoring, Environmental effects, Oil pollution, Resources development, Crabs, Shrimps, Fisheries, Alaska, *Outer Continental Shelf, Kodiak Shelf, Petroleum development.

Until recently little was known about the biology of the invertebrates of the shallow, nearshore benthos of Kodiak Island. Since these invertebrates may be the ones most affected by petroleum operations in waters adjacent to Kodiak Island, baseline data on these species are essential before industrial activities begin there. The objective of this study was to assess distribution and relative abundance of epifaunal invertebrates in selected bays and offshore areas; and to determine the feeding habits of the principal inshore epifaunal invertebrate species, emphasizing king crabs, and selected bottom fishes. Thirty-nine permanent benthic stations were established in two bays - 25 stations in Izhut Bay and 14

stations in Kiliuda Bay. Initial assessment of data suggests that a few unique, abundand and/or large invertebrate species (king crab, snow crab, several species of clams) are characteristic of the bays investigated and that these species may represent organisms that could be useful for monitoring purposes. It is also suggested that a complete understanding of the benthic systems of Kodiak waters can only be obtained when the infauna is also assessed in conjunction with the epifauna. Based on stomach analyses, infaunal species are important food items for king and snow crabs. (Sinha-OEIS)
W80-05054

ENVIRONMENTAL ASSESSMENT OF SELECTED HABITATS IN THE BEAUFORT AND CHUKCHI LITTORAL SYSTEM,
Western Washington Univ., Bellingham.
A. C. Broad, A. Benedict, K. Dunton, H. Koch, and D. T. Mason.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 361-542, October 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-81.

Descriptors: *Littoral, *Benthos, *Ecosystems, *Food webs, *Carbon, Water pollution effects, Environmental effects, Baseline studies, Oil pollution, Resources development, Alaska, *Outer Continental Shelf, Beaufort Sea, Chukchi Sea, Petroleum development.

Except for the Stefansson Sound Boulder Patch, there is no known unique or unusual benthic habitat in the Beaufort, inshore or nearshore regions. The Stefansson Sound region is a biological habitat that, for practical purposes, may be considered unique and, at least until this community and its overall contribution to the Beaufort Sea are better known than now is the case, should not be disturbed. Carbon from detritus of terrestrial origin enters the Beaufort marine food web through Gammarus setosus and, possibly other species. The full importance of this contribution is yet to be evaluated, but there are implications for attempts at shoreline stabilization and, interference with currents that transport materials alongshore. Data indicate a relationship between the presence of peat and the abundance of benthos. Because development which may require shoreline stabilization and interference with longshore transport are imminent and because this same development may introduce into the marine environment materials that can affect the availability of detrital carbon to the marine biota, it is important that the extent of this contribution and the pathways by which it occurs are known at the earliest possible date. (Sinha-OEIS)
W80-05056

NUTRIENTS DYNAMICS IN NEARSHORE ALASKAN BEAUFORT SEA WATERS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. M. Schell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 143-190, October 1979. 9 Fig, 5 Tab, 18 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-3-5-022-56.

Descriptors: *Productivity, *Aquatic life, *Carbon, *Nutrients, *Erosion, Environmental effects, Baseline studies, Water pollution effects, Oil pollution, Alaska, Resources development, *Outer Continental Shelf, Beaufort Sea, Nutrient cycles, Petroleum development.

The principal processes supplying energy (i.e. fixed carbon) to the biota of the Beaufort Sea coastal zone is described and related to the various nutrient chemistry regimes observed to this production of energy. The conclusions to date give evidence that the nearshore Beaufort Sea is decidedly different than more temperate Alaskan coastal zones with regard to the energy sources supporting the biota. The estimates of energy input to nearshore waters show that over 50% of the carbon input to nearshore marine biota (within approximately 10 km of shore) is terrestrially derived from two primary processes, fluvial transport and coastline erosion. The rivers carry large quantities of organic matter during spring break-up and coastal erosion occurs during summer months, resulting in the deposition of large amounts of organic carbon along the shoreline. This carbon is composed primarily of peat-like material that has been accumulating on land for up to 12,000 years. Thus the nearshore marine biome is apparently a 'fossil fuel' subsidized ecosystem wherein the meager annual primary production by ice algae and phytoplankton is supplemented by organic carbon eroded from coastal peat bluffs and transported by river flow into the coastal zone. The implications of oil and gas development are mostly indirect but potentially great. Development that would increase or decrease shoreline erosion or runoff characteristics could be expected to show corresponding impacts on the nearshore zone. (Sinha-OEIS)
W80-05060

COMPOSITION, TRANSPORT AND DEPOSITION OF SUSPENDED MATTER IN LOWER COOK INLET AND SHELIKOF STRAIT, ALASKA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, J. D. Cline, G. Massoth, A. J. Paulson, and M. F. Lamb.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 195-263, October 1979. 24 Fig, 8 Tab, 36 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Suspended solids, *Circulation, *Oil pollution, *Water pollution effects, Heavy metals, Trace elements, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development, Crude oil.

Of particular concern are the major accidents which cause massive oil spills, however, chronic release of oil through minor spills and localized transfer operations may be more important over the long term. Since crude oil is sparingly soluble in seawater, it tends to form emulsions when introduced into marine waters, especially under intense wave action. The emulsions have a high affinity for particles and tend to be adsorbed rapidly. Recent studies of oil spills in coastal waters containing high suspended loads have indicated rapid dispersal and removal of the oil by sorption onto particles along frontal zones. These zones are regions where turbid brackish water contacts seawater. The seasonal distributions, elemental composition, and fluxes of suspended particulate matter in lower Cook Inlet were studied and compared with current patterns and bottom sediment distributions. In general, the suspended matter distributions appear to follow the pattern of circulation in lower Cook Inlet and Shelikof Strait. The inflowing clear saline Gulf of Alaska water, which is enriched in biogenic particles of marine origin, flows northward along the eastern coast until it reaches the region near Cape Ninilchik where it mixes with the outflowing brackish water. Comparison of suspended matter and sediment characteristics as well as regional sedimentation rates indicates that net sedimentation of suspended matter in the central basin of lower Cook Inlet is minimal. However, net sedimentation is occurring in the embayments along the coast. (Sinha-OEIS)
W80-05061

DISTRIBUTION AND ABUNDANCE OF LOW MOLECULAR WEIGHT HYDROCARBONS AND SUSPENDED HYDROCARBONS IN COOK INLET, ALASKA,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05062

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM GULF OF ALASKA, BERING AND BEAUFORT SEAS,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 5B.
W80-05065

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Battelle-Northwest Labs., Richland, WA.
D. E. Robertson, and K. H. Abel.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 660-696, October 1979. 8 Fig, 13 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Heavy metals, *Sediments, *Baseline studies, Water pollution effects, Resources development, Environmental effects, Estuaries, Manganese, Vanadium, Alaska, *Outer Continental Shelf, Petroleum development.

The projected recovery of crude oil from the Alaskan continental shelves carries with it the risk of altering this environment by physical perturbations or spillage of crude oil. Such disturbances could result in detrimental impacts on the natural cycling of trace heavy metals in the shelf environment. It is therefore necessary to determine predevelopment evaluations of the trace metal distributions and behavior in promising shelf areas so that any future contamination may be identified, quantified and assessed. The primary objective of this study was to determine environmental baseline concentrations of selected heavy metals in seawater (both dissolved and suspended fractions), in sediments, and in selected marine 'indicator organisms' of the Alaskan study area. The work reported for this period centers around the analyses of samples collected in Cook Inlet during participation in two field cruises on May 4-15, 1978 and August 25-September 5, 1978. The results of analyses of sediments from the Beaufort Sea, Chukchi Sea, Norton Sound and the Shelikof Strait are also reported as well as the analyses of vanadium in biota from various shelf areas. (Sinha-OEIS)
W80-05066

POLLUTION: INTERNATIONAL CONVENTIONS, FEDERAL AND STATE LEGISLATION,
For primary bibliographic entry see Field 6E.
W80-05072

FEDERAL WATER POLLUTION CONTROL ACT - THE FEDERAL GOVERNMENT'S EXCLUSIVE REMEDY FOR RECOUPMENT OF OIL SPILL CLEANUP COSTS,
For primary bibliographic entry see Field 6E.
W80-05073

LAND USE CONTROLS IN COASTAL AREAS,
Kentucky Univ., Lexington
For primary bibliographic entry see Field 6E.
W80-05075

INTERNATIONAL ENVIRONMENTAL PROTECTION: POLICY, LEGAL, AND TRADE ASPECTS.
For primary bibliographic entry see Field 6E.
W80-05077

5D. Waste Treatment Processes

THE APPLICATION OF PHYSICAL AND CHEMICAL PARAMETERS TO THE DESIGN OF RAISED BED SOIL ABSORPTION SYSTEMS,
J. R. Smyth, and J. D. Lowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182033, Price codes: A06 in paper copy, A01 in microfiche. Maine Land and Water Resources Center University of Maine, Orono Project Completion Report, April 1980. 108 p, 12 Fig, 3 Tab, 115 Ref. OWRT A-040-ME(5).

Descriptors: *Sewage treatment, *Septic tanks, *Maine, *Optimization, Biochemical oxygen demand, Nitrogen, Pathogenic bacteria, Soil properties, Phosphorus, Oxidation-reduction potential, Denitrification, Absorption, Permeability, Domestic wastes.

The physical and chemical relationships involved in waste water treatment by raised bed soil absorption systems were quantified and improved design criteria for the treatment of nitrogen, phosphorus, organic carbon, and bacteria and viruses were developed. Study conditions were tailored to those found in Maine where approximately 50% of households are not linked to municipal sewage systems and as little as 15% of the land can accommodate conventional soil absorption systems. For each of the study pollutants, ammonium-nitrogen, nitrate-nitrogen, phosphorus, organic carbon, and bacteria and viruses, transport and retention in soils was investigated and these results were combined with field results from two systems in Maine to design optimum systems for each pollutant. Waste water production was estimated at 189 liters/capita/day for design purposes. Parameters considered for each design included pH, moisture content, temperature, redox potential, loading rate, soil texture, and soil composition. Results show that the only long term treatment for the removal of nitrogen is nitrification followed by denitrification. It is difficult to achieve substantial denitrification in a raised bed system but a nitrification/denitrification system is proposed. Chemical adsorption and precipitation were found to effectively remove phosphorus in raised bed systems. While all of the optimum designs are not compatible, a mutually satisfactory raised bed design is possible. (Seigler-IPA)
W80-04810

WASTE WATER FOR CROP IRRIGATION.
For primary bibliographic entry see Field 3C.
W80-04842

PROCEEDINGS OF A WORKSHOP ON ALTERNATIVE WASTEWATER TREATMENT SYSTEMS AT URBANA-CHAMPAIGN, ILLINOIS, JUNE 12-13, 1979.
Water Resources Center University of Illinois at Urbana Special Report No 10, August 1979. 150 p. 40.038, 79/20.

Descriptors: *Waste water treatment, *Conferences, *Illinois, *Alternative waste-water treatment, *Innovative treatment, *On-site management districts, *On-site treatment systems, *Wastewater disposal, 1977 Clean Water Act, Clustered treatment systems, Consulting engineers, Cost-benefit analysis, Treatment facilities, Funding, Land application-sludge, Land application-wastewater, California, Pressure sewers, Sewage disposal, Public participation-Illinois, Septic tanks, Wastewater Disposal Zone Act-Illinois.

The purpose of the workshop was to instruct consultants, local officials, and state agency personnel in the state of the art of alternative wastewater-treatment systems, including funding and institutional aspects. The workshop consisted of presentations by speakers from governmental agencies, universities, and consulting firms on the design of alternative systems, cost effectiveness, and the state and federal laws that apply. The workshop was divided into three parts: Policy and Regulations, Alternative and Innovative Systems, and Institutional Aspects.
W80-04936

JUDICIAL REVIEW UNDER FEDERAL POLLUTION LAWS,
Chicago Univ., IL.
For primary bibliographic entry see Field 6E.
W80-04996

THE UTILIZATION OF A FRESH-WATER WETLAND FOR NUTRIENT REMOVAL FROM SECONDARILY TREATED WASTE WATER EFFLUENT,
Michigan Univ. Ann Arbor. Dept. of Chemical Engineering.
D. L. Tilton, and R. H. Kadlec.
Journal of Environmental Quality, Vol 8, No 3, p 328-334, July-September 1979. 9 Fig, 6 Tab, 20 Ref. NSF AEN 75-08855.

Descriptors: *Nutrient removal, Plant growth, *Wastewater treatment, *Wetlands, *Houghton Lake(MI), Nitrogen, Nitrates, Nitrites, Phosphorus, Hydrology, Waste disposal, Sewage treatment, Sewage disposal, Waste dilution, Waste assimilative capacity, Effluents, Ammonia, Cattails, Discharge(Water).

Secondarily treated waste water applied to a freshwater wetland southwest of Houghton Lake, Michigan 1976-1977, showed that this wetland system was highly efficient in reducing dissolved nutrients. Although long-term vegetation changes are difficult to predict, annual effluent discharges into Houghton Lake wetland will probably favor plant species associated with wetter and more nutrient-rich conditions. Between May and September 1976, effluents were discharged with outlets every 9 m over a 200 m distance. Mean flow rate was 15.8 cu m/d; water depths were 12 cm at the pipeline. Prior to pumping, nitrate and nitrite concentrations were <0.01 mg/l at 25 m from the pipeline and remained at this level during discharge. Nitrogen averaged 0.36 mg/l in the effluent. Ammonium concentrations in the treated waste water were rarely greater than concentrations in wetland surface waters. Total dissolved phosphorus (TDP) concentrations averaged 0.01 mg/l prior to discharges. TDP averaged 0.41 mg/l in the effluent and 0.11 mg/l at sampling stations 25 m from the discharge. In 1977 a point-source distribution system was used. Effluent concentrations averaged 1.50 mg nitrate/l and 1.57 mg TDP/l. Within 30 m nitrate was 0.10 mg/l and within 80 m TDP was 0.07 mg/l in surface waters. Biomass, including live plants, standing dead plants and litter was not significantly different among sampling stations. However, Typa (cattail) dimensions were larger in the discharge area; maximum leaf length was 170 cm within 6 m of the pipeline compared to 145 cm 50 m from the discharge. (Danovich-Wisconsin)
W80-05033

5E. Ultimate Disposal Of Wastes

DEVELOPMENT OF ANIMAL WASTE FACILITIES FOR MINIMIZING WATER POLLUTION,
South Dakota State Univ., Brookings. Water Resources Inst.
J. L. Wiersma.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181357, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, March 1980. 68 p, 33 Fig, 5 Tab. OWRT A-036-SDAK(1).

Descriptors: *Feed lots, *Cattle, *Farm wastes, *Water pollution sources, Terracing, Agricultural runoff, Farm management, Feeds, Livestock, Decomposing organic matter, Water pollution, Groundwater, Confinement pens, South Dakota, Fertilization.

Three methods for controlling water pollution from animal wastes in feedlots are presented. The first method involves confining all wastes and water to the feedlot area until maximum decomposition occurs. A feedlot was designed to completely eliminate runoff and percolation thus creating a solids-liquid ratio on the surface to promote rapid decomposition. The lot had a dish shaped porous surface on a sand bed with imbedded collector drains. Perforated steel matting was used for the surface. This original design did not work well as cattle wastes and hair formed a nearly impermeable layer on the sand. The use of the sand filter was abandoned but the use of the perforated steel matting proved positive. The second method involved the use of a minimum area for the feedlot to favor decomposition and treatment of wastes. A system of diversion ditches and drying terraces was used to handle runoff and wastes from a sloped lot. Sample wells were used to study groundwater flow and quality near the terraces. General groundwater quality in the vicinity of the terraces was poor, however, results indicate that the drying terraces were not the cause of the poor quality. The third method involves the return of feedlot wastes to the land at a rate that does not inhibit full crop production. Factors that must be considered include climate, wastes, soils, crops, rotations, manure nitrogen content, and cattle feed type. Due to the lack of sufficient funding only preliminary results and conclusions were made for this method. (Seigler-IPA)
W80-04811

5F. Water Treatment and Quality Alteration

THE SELECTIVE REMOVAL OF NITRATE AND NITRITE FROM POLLUTED WATERS,
Kansas State Univ., Manhattan. Dept. of Chemistry.
W. C. Danen, and C. E. Meloan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180771, Price codes: A02 in paper copy, A01 in microfiche. Kansas State University Project Completion Report, April 1, 1980. Kansas Water Resources Research Institute. 19 p, 8 Tab, 18 Ref. OWRT A-079-KAN(1), 14-34-0001-8018.

Descriptors: *Nutrient removal, Methodology, *Nitrates, *Nitrites, Pollution, Ion-selective polymers, Water, Polyvinylbenzyl chloride, Nitron, Polyvinylbenzylnitron chloride, *Insoluble polymers, Toxicity, Methemoglobinemia, Ion-exchange polymer, Polymer-supported reagents.

The objective of the research project was to synthesize an insoluble polymer to remove nitrate and nitrite from water. A high capacity nitrate- and nitrite- selective polymer was synthesized by attaching nitron to commercial polyvinylbenzyl chloride (60/40 ortho/para isomers). The capacity of this polymer to remove nitrate and nitrite from 10 to the minus third power M solution was 67% and 42%, respectively. The compound 1-phenyl-2-diethylaminoethyl-4'-aminobenzoate was also synthesized and attached to commercial polyvinylbenzyl chloride (60/40 ortho/para isomers). The nitrate and nitrite selectivity of this polymer was realized and the capacity of this polymer to remove nitrate and nitrite from aqueous solution was 76% and 65.6%, respectively. 2-Diethylaminoethyl-4'-nitrobenzoate hydrochloride was synthesized but exhibited no tendency to complex/precipitate nitrate. Two other compounds, 1-(4'-nitrophenyl)-2-diethylaminoethyl-4''-nitrobenzoate hydrochloride and 1-(4'-aminophenyl)-2-diethylaminoethyl'4''-aminobenzoate hydrochloride, were synthesized and their abilities to precipitate nitrate from aqueous solution were compared to that of the nonsubstituted ester; the nitro-substituted compound was shown to be most efficient. Thus, a polymer was synthesized by attachment of 1-(4'-nitrophenyl)-2-diethylaminoethyl-4''-hydroxybenzoate to polyvinylbenzyl chloride (60/40 ortho/para isomers). The capacity of this polymer to remove nitrate and nitrite from aqueous solution was 80% and 68%, respectively. All of the synthesized polymers could be easily regenerated without loss of capacity and used repeatedly providing a possibility for commercial development.
W80-04869

SMYRNA, DELAWARE SOLVES A WATER PROBLEM,
Delaware Div. of Public Health, Dover. Office of Water Supply.
M. Joyce.
Water and Sewage Works, Vol 127, No 3, p 32, 42, March, 1980. 1 Tab, 13 Ref.

Descriptors: *Ground water, *Municipal water, *Water pollution treatment, *Aeration, Delaware, Water supply, Activated carbon, Organic wastes, Carcinogens.

A U.S. EPA organics monitoring survey detected trichloroethylene (TCE) in the municipal water system of Smyrna, Delaware. The town issued a public notice which recommended that all water used for drinking or cooking be boiled. Also, plans were made to either tap another aquifer or treat and monitor the contaminated aquifer. Since the contaminated levels were not abating and the source remained undetermined, it was decided to use TCE-removal techniques for the existing system. Granular activated carbon (GAC) was excluded due to its high cost. Aeration was used successfully to remove TCE. (Purdin-NWWA)
W80-04923

A RATIONAL APPROACH TO UTILIZATION OF CARBON BEDS IN REDUCING MICROORGANIC CONTAMINATION IN DRINKING WATER,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
F. A. DiGiano, W. H. Frye, and C. W. Baxter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182789, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts Publication No 109, 1980. 113 p, 42 Fig, 12 Tab, 39 Ref, 2 Append. OWRT A-091-MASS(1), 14-34-0001-6022.

Descriptors: *Activated carbon, *Water treatment, *Potable water, *Adsorption, *Fixed bed adsorbers, *Organic contaminants, *Drinking water treatment, Competition, Kinetics, Multi-component adsorption, Ideal adsorbed solution theory, Adsorption models, Methodology.

In the near future, granular activated carbon (GAC) adsorption beds will become more frequently used in water treatment for control of specific organic contaminants of concern to public health, e.g., the trihalomethanes and other low molecular weight chlorinated compounds. The problem of predicting GAC performance when a complex mixture of trace organics is present has not been solved. This research examined the anomalous, competitive adsorption of a specific organic compound, o-cresol, in the presence of acetophenone and in the presence of acetophenone and veratrole. Several competitive equilibrium models were used to no avail in explaining the reversal of expected preference for adsorption sites. The importance of considering adsorption rate in addition to adsorption equilibrium was demonstrated. The o-cresol adsorbed much more slowly than the other components, even though they all have very similar molecular diffusivities. Apparently, the form of the adsorbing species, solid vis-a-vis liquid, influenced adsorption kinetics. A small differential carbon contactor was demonstrated to provide a convenient means of screening the breakthrough behavior of mixtures of organic compounds. This rapid data gathering technique could be used in lieu of, or in addition to, mathematical models, especially when anomalous behavior is suspected. (Godfrey-Mass)
W80-05013

SELF-PURIFICATION OF RIVERS A TWO-PHASE MODEL FOR BACTERIAL BIODEGRADATION,
Centre Belge d'Etude et de Documentation des Eaux, Liege.
F. Edeline, and G. Lambert.
Water Research, Vol 13, No 6, p 473-480, 1979. 8 Fig, 20 Ref.

Descriptors: *Bacteria, *Self-purification, *Rivers, *Biodegradation, *Mathematical models, *Substrates, *Kinetics, Oxygen, Equations, Population dynamics, Monod equation, Oxygen sag, Chemical oxygen demand, Metabolism, Michaelis-Menten equations, Theoretical analysis, Waste assimilative capacity, Water pollution, Water pollution control.

A simple two-phase model accounts for 95% of total oxygen consumption during the bacterial phase of river self-purification. The two phases are characterized by a logistic model: phase one corresponds to a destruction of most substrate and formation of cellular reserves; phase two consumes these stored substances when external substrate is less attractive than endogenous reserves. The model is theoretically based on several well-established laws; it is restricted to the truly bacterial process, starting when pollutants are added and ending at the plateau value. Monod equations are used for bacterial dynamics. Validity of these theoretical equations is checked by oxygen sag curves. The total metabolized substrate is given by the difference between initial COD and plateau COD values. Five typical results are obtained with municipal sewage as substrate and river water as seeding. Biological zero is obtained after 31.5 h, irrespective of pollutant load. During the second phase as external substrates decrease and internal substrates increase, an equilibrium point occurs where both are equally available to cells. Experimental results show that the kinetic constant for external substrate metabolization is extremely sensitive to toxic or inhibitory influences and varies widely. The kinetic constant for endogenous respiration is fairly constant at 0.30-0.35. The proportion of external substrate converted into stored substances is not truly a constant but varies between narrow limits centered around 15%. (Danovich-Wisconsin)
W80-05028

EFFECTS OF HYPOLIMNETIC AERATION ON NITROGEN TRANSFORMATIONS IN SIMULATED LAKE SEDIMENT-WATER SYSTEMS,
Wisconsin Univ. Madison. Dept. of Soil Sciences.
For primary bibliographic entry see Field 5C.
W80-05031

SALINITY ASPECTS OF THE COLORADO RIVER AGREEMENT,
Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 6E.
W80-05093

5G. Water Quality Control

SETTLEABILITY OF URBAN RUNOFF POLLUTION,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182017, Price codes: A02 in paper copy, A01 in microfiche. Partial Completion Report, April 1980, 19 p, 10 Fig, 12 Ref. OWRT A-058-NJ(1), 14-34-0001-0132.

Descriptors: *Water pollution control, Water pollution, Pollution, Heavy metals, Oil pollution, Organic wastes, *Storm runoff, Coliforms, *Sediment control, Sediment, *Detention reservoirs, Storm water, *Settling basins, Urban runoff, *Storm water management, Dual purpose detention basins, *Settleability of pollutants.

Because of the growing interest in stormwater management, and particularly of the possibility of using detention basins for removing particulate pollution, it is important to determine the effectiveness of such basins for removal of various polluting substances. In the study reported upon, samples of urban runoff were allowed to settle in a large tube, and the quantity of each pollutant settling in a given time period determined. There was more variability in rate of settlement of specific pollutants than for total suspended solids. Lead and hydrocarbons settled out 60-65% in 32 hours, only slightly slower than total suspended solids. BOD and copper were removed at somewhat lower rates, and zinc even lower. Coliform counts were reduced by an order of magnitude. These results indicate the probable effectiveness of retention of stormwaters in removing particulate pollutants. The use of dual prupose detention basins, required to be built by developers as a condition of developing the land, is the only feasible means which has been found to prevent further increases in nonpoint source pollution in urbanizing areas. These concepts are now being applied in municipalities, counties and substate regional agencies.
W80-04807

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR SILVER CREEK, CLARK AND FLOYD COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-04861

REGULATION OF WATER POLLUTION FROM AGRICULTURAL POINT SOURCES IN NEBRASKA: IMPACT OF THE NPDES PERMIT PROGRAM ON FEEDLOT OPERATIONS,
For primary bibliographic entry see Field 6E.
W80-04925

OIL SPILLS: A PUBLIC OFFICIAL'S HANDBOOK,
State Univ. of New York Coll. at Potsdam. Dept. of Anthropology.
For primary bibliographic entry see Field 5C.
W80-04938

OIL SPILLS: A COASTAL RESIDENT'S HANDBOOK,
State Univ. of New York Coll. at Potsdam. Dept. of Anthropology.
For primary bibliographic entry see Field 5C.
W80-04939

PROTECTING AQUIFERS FOR THE FUTURE.
For primary bibliographic entry see Field 6F.
W80-04948

ACID MINE DRAINAGE AND THE PENNSYLVANIA COURTS,
Duquesne Univ. of the Holy Ghost, Pittsburgh, PA. School of Law.
For primary bibliographic entry see Field 6E.
W80-04966

FEDERAL CONTROL OF WETLANDS: THE EFFECTIVENESS OF CORPS' REGULATIONS UNDER SECTION 404 OF THE FWPCA,
For primary bibliographic entry see Field 6E.
W80-05005

SHIFTING EMPHASIS TO GROUND WATER,
Water Pollution Control Federation, Washington, DC.
P. J. Piecuch.
Journal Water Pollution Control Federation, Vol 52, No 3, p 441, March, 1980.

Descriptors: *Water pollution control, *Ground water, Regulations, Waste water treatment, Waste water disposal, Surface water, Water quality, Potable water.

The EPA is shifting its emphasis on water quality activities from surface water to ground water. This is due to the fact that 50% of urban residents and 95% of rural residents rely on ground water for potable purposes, and ground water supplies are 50 times greater than annual surface water flows in the U.S. Existing data on ground water quality are inadequate in the face of potential threats from pollution sources. As part of the EPA's National Ground Water Strategy, task groups have been formed, workshops have been set, strategy papers

will be published, and public hearings will be held. This change of emphasis is likely to cut across a wide range of regulatory programs and involve a shift from corrective measures such as effluent treatment to preventive measures, which is probably the only way to attack the ground water problem. (Purdin-NWWA)
W80-05059

BACTERIA: WHAT'S IN THE WATER.,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8A.
W80-05064

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COASTAL ZONE MANAGEMENT FROM AN ADMINISTRATIVE PERSPECTIVE: A CASE STUDY OF THE SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 6E.
W80-04919

IDENTIFYING AND MEETING TRAINING NEEDS FOR PUBLIC PARTICIPATION RESPONSIBILITIES IN WATER RESOURCES PLANNING,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 9B.
W80-05015

NEW NATIONWIDE HYDROLOGIC INVESTIGATIONS.
Ground Water Age, Vol 14, No 7, p 21-24, 40, 42, March, 1980. 1 Fig.

Descriptors: *Regional analysis, *Ground water resources, *Investigations, Hydrologic data, Aquifer systems, Aquifer management, Planning, Withdrawal, Computer models, Water quality, Forecasting, Economics.

Large supplies of ground water will be required in the coming decade for municipal, agricultural and industrial supplies. This may result in lowering ground water levels, degradation of water quality, and land subsidence. The understanding of the natural flow system and of the way in which it will respond-hydraulically, chemically, and structurally-to imposed stresses, is a necessary prerequisite to groung water development planning. To provide information on a regional scale, the U.S. Geological Survey has initiated a new series of hydrologic investigations--The Regional Aquifer System Analysis (RASA) Program. This program represents a systematic effort to study twenty-nine regional aquifers which cover much of the country and represent most of the national water supply. For interconnected aquifers, the study objective will be to define the regional hydrology and establish a framework-geologic, hydraulic, and geochemical-for detailed local studies. For systems composed of independent aquifers, the study objective will be to establish common principles governing the occurrence, movement and quality of ground water in the individual units. Every project will use computer models to analyze existing hydrologic regimes and provide predictive capabilities to estimate effects of future development. (Purdin-NWWA)
W80-05099

6B. Evaluation Process

RELIABILITY OF CYCLIC SURFACE AND GROUNDWATER STORAGE SYSTEMS FOR WATER SUPPLY: A PRELIMINARY ASSESSMENT,
Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
D. P. Lettenmaier, and S. J. Burges.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180870, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 64, November 1979. 70 p, 14 Fig, 8 Tab, 27 Ref. OWRT A-097-WASH(2).

Descriptors: *Model studies, *Water storage, *Reservoir storage, *Aquifer systems, Groundwater recharge, Pumping, Inflow water balance, Synthetic hydrology, Cost analysis, Feasibility studies, Markov processes, Mathematical studies, Stream flow.

A simplified cyclic water resources system involving a single surface reservoir and an adjacent storage aquifer was modeled and evaluated both physically and economically. If fixed annual water demand cannot be met by annual inflows to the surface reservoir, pumpage from the aquifer is used to supply the deficit. The aquifer is recharged by surface reservoir release during periods of reservoir inflow in excess of storage capacity. Parameters used to assess physical performance include indices of aggregate system supply deficits, pumping requirements, and the frequency of limitation situations such as empty or full aquifer, empty or full surface reservoir, and pumping or recharge equal to capacity. For the economic analysis a 40 year project life was assumed. Thirty-two physical and streamflow parameter combinations were used with the empirical cumulative distribution function of 18 performance measures to generate data. Recharge and pumping capacities were set to relatively large values so that system performance was generally governed by the combined storage capacity. For the situations modeled, pumpage from the aquifer was able to prevent system failure when surface supplies were not adequate. The least cost system was found to be one with the minimum surface storage needed to provide reliability for the system. Providing buffering against variations in stream flow by aquifer storage cost approximately an order of magnitude less than providing surface storage. (Seigler-IPA)
W80-04878

CULTURAL RESOURCE SURVEY AND TESTING AT THE MCGEE CREEK PROJECT, OKLAHOMA,
Environmental Assessments, Inc., Pauls Valley, OK.
P. McGuff.
Report, February 1980. 569 p, 83 Fig, 86 Tab, 19 Ref, 6 Append. 8-07-50-VO171.

Descriptors: *Surveys, *Archaeology, *Oklahoma, *History, *Dating, Land use, Population, Reservoirs, Erosion control, Project planning, McGee Creek Project.

An archaeological survey of the McGee Creek Project area in 1978 identified 435 localities of cultural activity of which 49 were evaluated and tested to develop approaches for reducing project related damage to the sites. The dam and reservoir for the project will involve 11,040 acres in southeastern Atoka County in Oklahoma. A brief history of the area is given. The area was once part of the Caddoan culture area that became sparsely settled by Old World people before it became Choctaw and Chickasaw land from 1830 to 1889. Early white settlers than came in mostly from the south. In general the area has been exploited for its resources and farming is not practical except on a very restricted basis. Parts of the project area were surveyed more intensly than others depending on the amount of destruction expected. A maximum interval of 20 meters was used for parallel survey transects. Site information collected and recorded included cultural affiliation, horizontal extent, vertical extent, physiographic location, condition, environmental placement, and potential significance. Three categories of sites were identified, 219 prehistoric, 52 historic, and 72 modern. It is recommended that a mitigation program be developed to sample 10% of the cultural fill at worthy prehistoric and historic sites and to study erosion at these sites and the possibility of constructing inhibitors to protect these sites from erosion. (Seigler-IPA)
W80-04881

THE CLEAN WATER ACT: UNEXPECTED IMPACTS ON INDUSTRY,
For primary bibliographic entry see Field 6E.
W80-04914

COASTAL ZONE MANAGEMENT FROM AN ADMINISTRATIVE PERSPECTIVE: A CASE STUDY OF THE SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 6E.
W80-04919

SOME IMPLICATION OF OCEAN RESEARCH,
Washington Univ., Seattle.
For primary bibliographic entry see Field 6E.
W80-04975

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A PRELIMINARY FEASIBILITY STUDY TO IRRIGATE WESTERN UMATILLA AND NORTHEASTERN MORROW COUNTIES, OREGON.
Oregon Dept. of Water Resources, Salem.
For primary bibliographic entry see Field 6G.
W80-05017

6D. Water Demand

NEW MEXICO'S NATIONAL FORESTS AND THE IMPLIED RESERVATION DOCTRINE,
For primary bibliographic entry see Field 6E.
W80-04989

ADMINISTRATIVE WATER RIGHTS INSPECTIONS IN CALIFORNIA,
For primary bibliographic entry see Field 6E.
W80-05000

A PRELIMINARY FEASIBILITY STUDY TO IRRIGATE WESTERN UMATILLA AND NORTHEASTERN MORROW COUNTIES, OREGON.
Oregon Dept. of Water Resources, Salem.
For primary bibliographic entry see Field 6G.
W80-05017

6E. Water Law and Institutions

THE CLEAN WATER ACT: UNEXPECTED IMPACTS ON INDUSTRY,
C. J. Koch, and R. A. Leone.
The Harvard Environmental Law Review, Vol 3, p 84-111, 1979.

Descriptors: *Economic impact, *Cost analysis, *Federal Water Pollution Control Act, *Industrial production, Industries, Decision making, Legislation, Costs, Federal government, Administrative agencies, Water pollution control, Economics.

The possible unanticipated economic and political consequences of water pollution controls imposed by the 1972 Clean Water Act on the tissue paper industry are examined. Analyzed in detail are the economics of regulation. It is suggested that as a direct result of governmental regulation a differential in the industry compliance cost curve will exist. This impact on the compliance cost curve may raise problems of economic equity among competing producers and between producers and consumers. The imposition of water pollution controls on the tissue industry has reduced the number of plant closings, and actually extended the life of existing plants. This is primarily based on the rationale that new capacity has higher abatement

costs than existing capacity. Given the compliance cost curve's importance, the likelihood that the federal Environmental Protection Agency would undertake a conscious policy of manipulating or managing its shape is examined. This could be effectuated by enacting a policy of leniency for high-cost abaters, with consumers as the primary beneficiaries. The analysis concludes that a conscious policy of curve shaping is unlikely due to legal constraints and resource limitations. (Schwerer-Florida)
W80-04914

ANNUAL REVIEW OF ACTIVITIES - 1975: WATER RESOURCES COMMITTEE, ARIZONA.
American Bar Association, Washington, DC. Natural Resources Section.
Natural Resources Lawyer, Vol 9, No 2, p 319-53, 1976.

Descriptors: *State governments, *Legislation, *Judicial decisions, *Water rights, Administrative agencies, Water law, Environmental effects, Legal aspects, Federal jurisdiction, Water pollution control, Water policy.

In Arizona bills were introduced providing for county water conservation districts. Two suits involving groundwater uses were filed on behalf of the Papago Indians. In California, Appellate Courts issued important decisions in two groundwater cases and touched upon the delicate area of federal-state relations. In Colorado, the important cases dealt with the adjudication of water rights, disputes over ownership, and Denver's delivery of water outside it political boundaries. The important state water legislation concerned tabulation of adjudicated water rights, condemnation of water rights by municipalities, water supply, definition of different types of pollutant discharges, and classification of permits. In Idaho, the Idaho Supreme Court ruled that the United States must quantify all of its reserved water rights. In Maine, the legislature enacted legislation limiting or prohibiting the anchorage of oil carrying vessels in Maine coastal waters. In New Mexico, the legislature established the framework for water research, conservation and development projects. In Oregon, the offices of the State Engineer and the Water Resources Board were combined. In Utah, legislation was proposed which would change enacting Utah's appropriation system. (Wilson-Florida)
W80-04915

BOUNDARY DELIMITATION IN THE ECONOMIC ZONE: THE GULF OF MAINE DISPUTE.
Maine Law Review, Vol 30, No 2, p 207-245, 1979. 10 Fig.

Descriptors: *Canada, *United States, *Law of the sea, *Boundary disputes, Political aspects, Boundaries(Surface), Oceans, International law, Jurisdiction, Continental shelf, International waters.

The realities of randomly concentrated and limited resources, complicated by the political geography of the oceans, have made maritime boundary delimitation a crucial international issue. Maine boundary delimitation falls into three broad categories. First is the drawing of baselines along a coast that will close off a nation's internal waters. Second, is the seaward limit of the various marine zones of national jurisdiction. The third is the international maritime boundary between adjacent and opposite states. A three-part analytical process is presented in the delimitation of international boundaries in the economic zone. First, the legal history of boundary delimitation in other marine zones is reviewed. Second, current proposals for economic zone boundary delimitation at the Third United Nations Conference on the Law of the Sea are analyzed. Finally, an assessment is given of the current economic zone boundary dispute between the United States and Canada in the Gulf of Maine. (Wilson-Florida)
W80-04916

EFFICIENCY IMPACTS OF COST SHARING ON SHORELINE MANAGEMENT,
National Bureau of Standards, Washington, DC.
H. E. Marshall.
Coastal Zone Management Journal, Vol 2, No 4, p 369-382, 1976. 3 Tab.

Descriptors: *Cost-sharing, *Shore protection, *Flood protection, Conservation, Shores, Protection, Programs, Beach erosion, Federal government, Management.

The nation's shorelines are being eroded by high winds and waves. As man continues to settle upon and develop on the ocean and Great Lakes shorelines, the concern over protection against human injuries and property damages from high winds and waves increases. Non-federal interests have traditionally received federal help in the form of cost-sharing for protective structures. Existing and alternative cost-sharing rules for shoreline protection are compared on the basis of economic efficiency. Both engineering and management techniques are examined for beach erosion, hurricane and emergency coastal flood protection. The present cost-sharing system appears to influence local interests to choose costly techniques of protection, engineering rather than management techniques, and under certain conditions, inefficient and overbuilt protective structures. These biases could be reduced if all engineering and management techniques for reducing shoreline damages were subject to the same percentage cost-sharing rules. (Daniels-Florida)
W80-04917

FEDERAL CONSISTENCY AND STATE EXPECTATIONS,
W. C. Brewer, Jr.
Coastal Zone Management Journal, Vol 2, No 4, p 315-325, 1976.

Descriptors: *Coasts, *Shore protection, *Zoning, Federal government, Land management, Programs, Administrative agencies, Legislation, Regulation, State government, Management.

The 1972 Coastal Zone Management Act requires federal projects be consistent with approved state coastal management programs. This is an important incentive for states to complete their programs. There are state obligations also. As a condition of program approval, states must first consult with the federal agencies concerned and provide opportunity for comment to avoid conflicts. This mechanism protects the federal agencies' interests. States must also give adequate consideration to the national interests involved in the siting of facilities necessary to meet non-local requirements. The federal consistency requirement is subject to various exceptions whose scope remains undetermined. One such uncertain exception is the exclusion from the coastal zone of federal lands 'the use of which is subject solely to the sole discretion ... of the federal government....' Despite these uncertainties, the consistency provision represents a major change in federal policy, which has traditionally allowed federal agencies to operate largely without concern for state land or water use requirements. (Daniels-Florida)
W80-04918

COASTAL ZONE MANAGEMENT FROM AN ADMINISTRATIVE PERSPECTIVE: A CASE STUDY OF THE SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION,
Texas A and M Univ., College Station.
G. C. Swanson.
Coastal Zone Management Journal, Vol 2, No 2, p 81-102, 1975. 1 Fig, 3 Tab.

Descriptors: *California, *Coasts, *Project post-evaluation, *Shore protection, Legislation, Management, Conservation, Development, Regulation, Planning, California, Resources development, Administrative agencies.

Competent administration of the 1972 Coastal Zone Management Act (Act) must proceed on an informed understanding of the organizational styles and capacities of agencies presently dealing with similar problems. One such agency is the San Francisco Bay Conservation and Development Commission, the forerunner of the California model of coastal management. An analysis of this model can shed light on what can be expected administratively as the Act becomes an operational reality. The major administrative insights offered fall into the following areas: (1) effectiveness assessment - the Commission's success can be systematically defined and measured, with important implications for coastal resource management; (2) organizational success - the Commission's administrative style can be analyzed in terms of the synergy which has been created between its organizational structure and decision-making process; and (3) implications of agency success - the Commission's most valuable lessons can be identified and applied to other situations. (Wilson-Florida)
W80-04919

COASTAL LAND USE CONTROL IN SWEDEN,
San Diego Univ., CA. School of Law.
R. G. Hildreth.
Coastal Zone Management Journal, Vol 2, No 1, p 1-29, 1975. 6 Fig.

Descriptors: *Foreign countries, *Coasts, *Shore protection, *Land use, State governments, Development, Legislation, Regulation, Conservation, Environmental control, Building codes, Public rights.

Several states in the United States recently adopted some form of special control over coastal land use, stimulated in part by the 1972 federal Coastal Zone Management Act (Act). Under the Act, 30 states are eligible for grants to assist them in developing and administering such coastal land use controls. In Sweden, such controls have been greatly expanded by recent amendments to existing legislation. Regulation of coastal land use occurs at all levels of government in Sweden. Prior to the adoption of legislation, Swedish customary law provided a limited form of coastal land use control. The 1952 Shoreline Act was enacted to implement and perpetuate this body of law. The 1964 Nature Conservacy Act gave Swedish counties the power to declare protected zones, in which building permits were required. Other Swedish legislation includes the Environment Protection Act, the Building Act, and the Expropriation Act. Recent amendments to these acts decrease the compensation due coastal landowners for restrictions placed on the use of their property and increase the specificity in the planning processes for coastal areas. These techniques are relevant to coastal zone management in the United States. (Wilson-Florida)
W80-04920

SHORELINE DEVELOPMENT CONTROLS AND PUBLIC ACCESS TO THE OCEAN'S EDGE,
California Coastal Zone Conservation Commission, San Francisco.
T. Crandall.
Coastal Zone Management Journal, Vol 1, No 4, p 451-466, 1974. 6 Fig, 1 Tab.

Descriptors: *California, *Shore protection, *Land development, Land use, Resources development, Recreation, Coasts, Local governments, Aesthetics, Public benefits, Environmental control.

The San Diego Coast Regional Commission is faced with the responsibility of approving, approving with conditions, or denying permits for development proposed along the scenic coastal bluffs of San Diego County. It has adopted guidelines for bluff-top development which assure retention of scenic vistas and public access, while permitting private landowners reasonable use of their property. These unique guidelines delineate certain environmental and aesthetic parameters within which bluff-top development may take place. The four major guidelines require development to: (1) enhance the overall appearance of the coastal bluff area, by encouraging the use of landscaping and exterior building materials that complement the natural form, texture and color of the coastal bluffs; (2) preserve adequate vista corridors

through each coastal bluff-top project; (3) provide public access from the nearest public street to and along the bluff edge; and (4) preserve the coastal bluff face in its natural condition. An integral part of the commission's guidelines was landscape criteria designed to ensure the continued attractiveness of coastal bluffs. The bluff-top guidelines have been accepted as reasonable by developers. (Wilson-Florida)
W80-04921

ESTUARINE SANCTUARIES - THE OREGON EXPERIENCE,
J. F. Ross, and D. L. Hepp.
Coastal Zone Management Journal, Vol 1, No 4, p 433-446, 1974. 4 Fig, 1 Tab.

Descriptors: *Oregon, *Estuaries, *Shore protection, Legislation, Estuarine environment, State governments, Coasts, Resources development, Ecology, Estuarine fisheries, Environmental control.

In response to the growing recognition of the critical importance of estuaries and the intense pressure to change them, the Coastal Zone Management Act established a program to assist states in long-term protection of selected natural estuarine areas. A nationwide system of estuarine sanctuaries will be created to preserve, for research and education, areas respresentative of each of the major biogeographical estuarine types. Oregon's candidate, the South Slough of Coos Bay, is the first area selected as an estuarine sanctuary by the federal Office of Coastal Zone Management, largely because of early groundwork done by local people. The establishment of an estuarine sanctuary is complicated by interwoven ecological, social, economic and political issues. The potential benefits of the protection of an irreplaceable resource and the contribution to coastal zone management unquestionably justify the effort. Oregon anticipates completion of purchases and agreements and the establishment of the South Slough estuarine sanctuary by early spring 1975. (Wilson-Florida)
W80-04922

SAVING CALIFORNIA'S COAST: THE COASTAL ZONE INITIATIVE AND ITS AFTERMATH,
Resources for the Future, Inc., Washington, DC.
R. G. Healy.
Coastal Zone Management Journal, Vol 1, No 4, p 365-394, 1974.

Descriptors: *California, *Coasts, *Shore protection, *Land use, Buildings, Regulation, Permits, Construction, Coastal structures, Development, Recreation, State governments.

In 1972 California voters approved a proposal that would give control over nearly all construction along its entire coast to powerful state and regional commissions. By the end of 1975, these commissions must present an enforceable coastline plan to the legislature. Meanwhile, they have broad power to prevent or modify proposed building in an area extending from 3 miles offshore to 1,000 yards inland from the shoreline. The permit zone includes a wide variety of natural environments and possible area uses, including open water, large tracts of undeveloped land, beach towns and resorts, and some of the nation's most valuable urban property. In dealing with permit decisions, the commissions have had to face the real problems of the coast. The coastal regulators have acted on more than 5,000 permits, including controversial issues of beach access, density, agricultural preservation, power plant siting, and growth inducement. The state commission has interpreted its powers broadly, and counteracted an initial timidity on the part of the regional boards. (Wilson-Florida)
W80-04924

REGULATION OF WATER POLLUTION FROM AGRICULTURAL POINT SOURCES IN NEBRASKA: IMPACT OF THE NPDES PERMIT PROGRAM ON FEEDLOT OPERATIONS,
H. C. Harris, and M. Hendricksen.
Creighton Law Review, Vol 9, No 1, p 83-101, September 1975.

Descriptors: *Nebraska, *Agricultural runoff, *Pollution abatement, *Feedlots, Permits, Federal water pollution control act, Environmental effects, Livestock, Remedies, Water pollution control, Agriculture, Water pollution sources.

The National Pollutant Discharge Elimination System, NPDES, incorporated into the Nebraska plan, prohibits the discharge of pollutants from a point source into any Nebraskan waters without a permit. Animal confinement facilities, or feedlots, are point sources. Every Nebraska feedlot operator with a present or potential pollution discharge into Nebraskan waters must apply for an on-site inspection. The inspection determines whether the operator must obtain an NPDES permit and/or construct livestock waste controls. To ensure compliance with the required standards, a monitoring system may be established. Any feedlot operator in violation of effluent limitations, permit conditions, or administrative orders may be subject to administrative penalties, injunctions and civil or criminal suits by either state or federal authorities. The effectiveness of Nebraska's regulation of water pollution from livestock waste runoff and other sources is evaluated under its state administered NPDES permit program. (Schwerer-Florida)
W80-04925

AN EVALUATION OF LOUISIANA SUPERPORT STUDIES AND IMPLICATIONS FOR COASTAL ZONE MANAGEMENT,
Louisiana State Univ., Baton Rouge. Dept. of Marine Sciences.
J. H. Stone.
Coastal Zone Management Journal, Vol 3, No 1, p 7-37, 1976. 2 Fig, 2 Tab, 30 Ref.

Descriptors: *Louisiana, *Coasts, *Shore protection, *Research and development, Environmental effects, Decision making, Management, Analytical programs, Economic impact, Techniques.

The economic and environmental consequences of a proposed Louisiana superport have been studied the last three years. These studies provided technical information and management alternatives. These studies are evaluated to derive implications, to make suggestions and to point out some analytical tools for coastal zone management. Management alternatives included: (1) state control to avoid multiple superport developments; (2) details for an Environmental Protection Plan; (3) comparisons of onshore and offshore sites; and (4) planning for ancillary development. Policy decisions which resulted include many of the research recommendations. Recommended environmental goals are listed. Six general features of the superport studies that are related and important to coastal zone management are discussed. Environmental research can influence policy decisions and limit available options provided some legal structure is created, quality control is implemented, and technological and environmental problems are recognized. Various analytical tools, such as energy cost-accounting, group critique and simulation models, have wide application for use in coastal zone management. A bibliography is included. (Daniels-Florida)
W80-04926

IDENTIFYING THE 'PUBLIC' FOR PARTICIPATION IN COASTAL ZONE MANAGEMENT,
California State Office of Planning and Research, Sacramento.
J. Ashbaugh, and J. Sorensen.
Coastal Zone Management Journal, Vol 2, No 4, p 383-409, 1976. 2 Tab, 29 Ref, 2 App.

Descriptors: *Coasts, *Shore protection, *Project planning, Planning, Administration, Regulation, Legislation, Surveys, Programs.

The federal Coastal Zone Management Act requires each coastal state apply for certification of its plan to design and implement a program of public participation. One of the more difficult aspects of public participation is the explicit identification of those groups and individuals who constitute the public with whom the coastal zone management agency will interest and collaborate in program development. Many factors raise difficulties in identifying and maintaining contact with the public. Five methods can be used to identify organized public groups: (1) self-identification; (2) snowballing; (3) directory research; (4) issue analysis; and (5) substitute advocacy. These methods, either alone or combined, can sufficiently identify those groups and individuals with whom the coastal management agency will interact, though other methods exist. A form survey is described that was designed to identify and maintain contract with groups that desired to participate in the development of California's coastal plan. (Daniels-Florida)
W80-04927

GROUNDWATER AUGMENTATION PLANS IN COLORADO,
J. P. McMahon.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 552-566, 1976.

Descriptors: *Colorado, *Groundwater resources, *Water allocation(Policy), Prior appropriation, Water rights, Consumptive use, Legal aspects, Diversion, Diversion loss returns, Water supply, Groundwater resources.

The Colorado Supreme Court recently confronted two appeals from Colorado water courts. The dispute regarded questions relating to the attributes of Colorado water rights and the administration of these rights in accordance with the priority system. Both applicants sought court approval of augmentation plans under the Colorado statutes. The diversions under the proposed operations could be larger than those historically attributable to the water rights used for augmentation. Opponents argued that to grant permits would be a major break in the doctrine of prior appropriation; that these were not augmentation plans but really changes to water rights. In granting the permits, the Supreme Court interpretation of the phrase 'plan of augmentation' found the applicants to be within the scope and intent of the pertinent Colorado statutes. In the court's opinion, water was available for appropriation if no injury occured. Under these cases, an individual, low consumptive user, wanting to change his water use or bring new usages into the system may be required to rectify only the depletive effects of such water use. (Schwerer-Florida)
W80-04928

THE ROLE OF THE STATE IN WATER PLANNING, RESEARCH, AND ADMINISTRATION,
Colorado Dept. of Natural Resources, Denver.
H. D. Sherman.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 449-453, 1976.

Descriptors: *Colorado, *Water management(Applied), *Water resources development, State governments, Administrative agencies, Waste disposal, Beneficial use, Legal aspects, Colorado River, Regulation, Legislation, Planning.

The future role of the Colorado State Government in water resource planning is evaluated. In view of changing conditions, state regulation and control will require adaptation. Several key areas of change are perceived. Initially, increased water consumption and salinity problems will increase the frequency of water rights transfer, change in point of diversion, and change in use. Additional areas of change analyzed include large-scale water resource developments, state government growth policy, and the managerial function of state agencies. Suggested changes in the pure appropriation system are also explored, with comparisons to Wyoming and Utah. Since Colorado water law now assumes that all growth and development give rise to 'beneficial use' of water, a legislative clarification is needed to develop effective guidelines for state water policies. Several other areas of needed change are examined and possible improvements are suggested. (Schwerer-Florida)
W80-04929

INTERSTATE RIVER COMPACTS: IMPACT ON COLORADO,
Upper Colorado River Commission, Salt Lake City, UT.
I. V. Goslin.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 415-439, 1976. 1 Tab, 1 App.

Descriptors: *Colorado, *Colorado River, *Colorado River compact, *Interstate compacts, Conservation, Interstate rivers, Water resources, Water contracts, Consumptive use, Water conservation, Water allocation(Policy), Water quality.

Water compacts to which Colorado is a party influence the nature and direction of future state development, conservation, and utilization of water resources. Compacts are a mutually agreeable means of settling existing water disputes and preventing future controversies over the waters of interstate streams. To date, Colorado is a party to nine interstate water allocation compacts and to three interstate agreements that can be designated as subcompacts. Their terms have served as parameters for resource development processes. The Colorado River compact is regarded as the grandfather of water allocation compacts in the United States. The following is a listing of the remaining eight compacts to which Colorado is a party: La Plata River compact, South Platte River compact, Rio Grande compact, Republican River compact, upper Colorado River Basin compact, Arkansas River compact, Costilla Creek compact, and the Animas-La Plata Project compact. Compacts have been beneficial to Colorado in protecting the use of interstate waters against prior appropriation and use in other states. Other areas of significant impact include water quality, water supply and litigation. (Schwerer-Florida)
W80-04930

THE ROLE OF WATER IN THE HISTORY AND DEVELOPMENT OF COLORADO,
D. Lavender.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 407-414, 1976.

Descriptors: *Colorado River, *Colorado River basin, *Colorado River compact, *Colorado, Agriculture, Mining, Prior appropriation, Mountains, Beneficial use, Interstate compacts, Interstate rivers.

Water's role in Colorado's development is controlled largely by geography. High elevation causes the capture of a disproportionate amount of rainfall, and the streams created are difficult to control. Agriculture was the first water use, but the law that developed grew out of the mining industry. With increasing colonization came conflicts over accelerated demands on water resources, especially the Colorado River. Intrastate problems were settled by the law of prior appropriation. This was not adequate for interstate problems, and compacts were necessary instead. Colorado got 52% of the Colorado River's upper basin, all of which originates on Colorado's western slope. Since there was little beneficial use there, the Eastern slope has been appropriating it. Now there is opportunity for profitable development on the western side, and a fear that the water resources will be insufficient. The outcome is unclear, but prior history indicates that a compromise might be a better solution than strict prior appropriation law. (Tabano-Florida)
W80-04931

GLOBAL WATER LAW SYSTEMS AND WATER CONTROL,
Colorado State Univ., Fort Collins.
G. E. Radosevich.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 263-282, 1976. 1 Fig.

Descriptors: *Water allocation(Policy), *Water control, *Water management(Applied), *Consumptive use, Water consumption(Except consumptive use), Water rights, Water law, Water policy, Water resources, Water supply, Governmental interrelations.

Water laws are viewed as policy expressions that must be dynamic and the product of evolutionary processes. Several water systems of the entire world are summarized here. Systems with a customary religious base view water as part of man's cosmogony, allowing no private ownership. Latin American nations use either a traditional, riparian-influenced system, or a modern system of state comprehensive water management. Several European systems are discussed, such as the United Kingdom's governed entirely by statute. The federated system of the United States is also summarized, as are the common law - influenced Asiatic systems. Eight general conclusions are reached: (1) there is a clear tendency toward public ownership; (2) the basin is an imperative for improved management; (3) users should have input in decision-making; (4) unity is needed at all government levels; (5) water courts should be established; (6) 'acquired' rights must be redefined; (7) vested rights should not be a permanent constraint; and (8) specialists need an interdisciplinary foundation. (Tabano-Florida)
W80-04932

FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976: AN ACCOMMODATION OF STATE, FEDERAL AND INTERNATIONAL INTERESTS,
A. J. Tassi.
Case Western Reserve Journal of International Law, Vol 10, No 3, p 703-738, Summer 1978.

Descriptors: *Fish conservation, *Fish management, *Law of the seas, Fisheries, International law, Regimes, Federal government, Conservation, Legislation, Regulation, Jurisdiction.

The impact of the 1976 Fishery Conservation and Management Act (FCMA) upon traditional regulatory and conservation efforts of fishery resources is examined. Primary emphasis is given to fishery jurisdiction in United States (U.S.) coastal waters. The traditional approach to fishery jurisdiction is analyzed in the context of an Alaskan Supreme Court decision, State v. Bundrant. This case accurately illustrates the conventional interplay among state, federal, and international interest and the treatment accorded each before the FCMA. By enacting the FCMA Congress entered into the field of extraterritorial fishery jurisdiction. They provided a national regulatory authority aimed at accomodating state, federal and international interests. The pertinent FCMA provisions, and their impact upon state and federal management interests are examined. The FCMA's influence in the area of international fishery affairs is discussed, including the mandatory revision of certain U.S. obligations. The potential tensions which could result from this requirement to renegotiate treaties is examined. Overall, the FCMA is evaluated favorably. (Daniels-Florida)
W80-04933

WATER LEGISLATION PERSPECTIVES FOR ALABAMA,
Alabama Univ., University.
H. Cohen.
Alabama Law Review, Vol 26, No 1, p 177-213, Fall 1973.

Descriptors: *Alabama, *Water resources, *Water allocation(Policy), Regulation, Water utilization, Water policy, Water rights, Legislation, Water users, Control, Administration.

Alabama's response to the problems inherent in the allocation and use of water is examined. The court's are unable to plan and coordinate water allocation, as is illustrated by hypothetical situations. The problem areas discussed include riparian rights, groundwater use, and diffused surface water and the control of watercourses. Legislation of states other than Alabama enacted to alleviate the above problems is examined. The controls over individual users necessary to effectively implement comprehensive planning give rise to constitutional attacks on water use statutes. Two grounds for a constitutional challenge are improper delegation of legislative authority and takings. Potential challenges to Alabama's water rights legislation are examined. A legislative approach to water control is suggested to Alabama legislative which will help Alabama take a bold step in the direction of state water control. (Daniels-Florida)
W80-04934

MANAGING RECREATIONAL RIVERS,
National Association of Attorneys General, Raleigh, NC.
B. A. Rich.
Akron Law Review, Vol 8, No 1, p 43-56, Fall 1974.

Descriptors: *Illinois, *Recreation facilities, *Public access, Recreation, Navigable waters, Recreation demand, Public rights, Riparian rights, Regulation, State governments, Legal aspects.

Various regulatory approaches are discussed to provide and protect rivers with potential for use as public recreational facilities. These approaches are applied to the rivers of Illinois. Whenever public use of natural watercourses is considered, the concepts of riparian rights and navigability are fundamental issues. The evolution of these doctrines and their relation to public recreational water use are discussed. Methods by which Illinois may acquire riparian land to expand water-based recreation facilities, and the problems created by such methods of acquisition are discussed. By using examples of other state methods used to acquire water rights for the general public, alternative methods for acquiring recreational facilities for the public are presented. These alternative methods are progressive reform measures, enabling a state to provide needed recreational facilities. (Daniels-Florida)
W80-04935

THE LEGAL IMPLICATIONS OF GROUND WATER HEAT PUMP USE,
National Water Well Association, Worthington, OH.
J. Miller.
Ground Water Heat Pump Journal, Vol 1, No 1, p 29-35, Spring, 1980. 1 Tab.

Descriptors: *Heat pumps, *Legal aspects, *Permits, Ground water, Water quality, Water utilization, Well permits, Well regulations, Regulation, Government, Legislation, Water pollution control, Waste water disposal, Effluents, Injection wells, Local governments, Domestic water, Water law, State governments.

Federal, state, and local laws and regulations may impede ground water heat pump use. In many areas the drilling of a well requires a permit unless it has a certain capacity or is used for domestic purposes. In some areas the use of ground water for heating or cooling is not considered domestic use. Disposal of heat pump effluent is also subject to statutes and regulations such as the National Pollutant Discharge Elimination System (NPDES) and the Underground Injection Control Program (UIC). Federal regulations pertaining to ground water quality will not have a significant impact as the wells used for heat pumps are Class V wells under the UIC program. At the state level, well construction requirements vary. The expense of these requirements may make heat pump use impractical. Where water use restraints exist, usually in the form of permit requirements, they are not serious deterrants to heat pump use. Some local controls on well construction, ground water use and quality, and waste disposal may adversely affect heat pump utilization. Most local regulations, however, will not seriously impede widespread use of heat pumps. A summary table lists state regulations for domestic ground water heat pump use and effluent disposal. (Purdin-NWWA)
W80-04957

A 'COMMON HERITAGE' APPROACH TO FISHERIES THROUGH REGIONAL CONTROLS,
M. J. Brodd.
New York Journal of International Law and Politics, Vol 10, No 1, p 171-202, Spring 1977.

Descriptors: *Law of the Sea, *Marine fisheries, *Regional development, United Nations, Interna-

tional law, Treaties, International waters, Regimes, Resources development, Resource allocation.

The 1977 Informal Composite Negotiating Text (ICNT), produced by the United Nations, provides that seabed resources beyond the limits of national jurisdiction, will be controlled by an international authority for the benefit of all nations. The approach is exploitation pursuant to the common heritage of mankind. The ICNT also establishes an Exclusive Economic Zone for each coastal nation for fishery exploitation with a breadth of 200 miles. Landlocked states are permitted to share in the exploitation of fisheries within adjoining state's exclusive zones. If the ICNT is adopted, one problem will be to harmonize the concepts of exclusive national rights of a coastal state in its economic zone and the landlocked nations rights to share in that zone's resources. The possibility of required organizations as a means of implementing these competing rights is explored. Regional agreements and control are a viable compromise. An international regime of multistate regional arrangements is justified by and consistent with the common heritage principle. Under regional regimes, the benefits of both these competing approaches to resource utilization can be realized within the spirit of international cooperation. (Daniels-Florida)
W80-04960

PROSPECTS FOR DEEP SEABED MINING,
L. S. Ratiner.
The Journal of International Law and Economics, Vol 12, No 2, p 191-194, 1978.

Descriptors: *Beds under water, *International waters, *Mining, *Law of the Sea, United States, Legislation, Regimes, International law, United Nations, Treaties, Resource development.

United States (U.S.) legislation is needed to promote private development of ocean mining and to facilitate the establishment of an international mining enterprise. Ocean mining will help the U.S. become more self-sufficient in its supplies of various resources, such as cobalt, copper, mangenese and nickel. Reliance on countries advocating producer cartels creates the risk of supply interruptions. Emerging economic nationalism in developed countries further decreases opportunities for foreign investment in resource development. The key difficulty in the development of ocean mining is that investments made under present international law could be significantly impaired by a later treaty. This risk must be reduced, if not removed. The traditional approach has been to provide grandfather rights in new laws for previous investments. In the case of a treaty, this would require agreement by many countries. The U.S. should assure that industry is compensated for its investment losses. The establishment of an international mining enterprise would hasten if domestic legislation were enacted and mining began promptly. If other countries see the U.S. aggressively pursuing ocean mining they will be motivated to negotiate a treaty. (Daniels-Florida)
W80-04961

AN ANALYSIS OF THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978,
Nossaman, Waters, Krueger, Marsh and Riordan, Los Angeles, CA.
R. B. Krueger, and L. H. Singer.
Natural Resources Journal, Vol 19, No 4, p 909-927, October 1979.

Descriptors: *Continental shelf, *Resources development, *Water pollution control, Continental slope, Legislation, Energy, Federal government, Oil spills, Coasts, Leases, Administrative agencies.

Beneath the 1.3 million square miles of continental shelf over which the United States has jurisdiction, there exists an enormous quantity of energy resources. The first federal act to authorize the leasing of the resources of the Outer Continental Shelf (OCS) was the 1953 Outer Continental Shelf Lands Act. This statute remained unchanged until the passage of the 1978 Outer Continental Shelf Lands Act Amendments (1978 Act). While the bulk of the 1978 Act consists of amendments to the 1953 Act, it also establishes an Offshore Oil Spill Pollution Fund and a Fisherman's Contingency Fund, and amends the 1972 Coastal Zone Management Act. The major policy objectives of the 1978 Act include: (1) making oil and other natural resources available; (2) protecting the environment; (3) maintaining free enterprise competition with respect to resources development; and (4) providing coastal states with an opportunity to participate in policy and planning decisions relating to the resources of the OCS. (Wilson-Florida)
W80-04962

THE COASTAL AREA MANAGEMENT ACT IN THE COURTS: A PRELIMINARY ANALYSIS,
North Carolina Univ. at Chapel Hill.
P. G. Glenn.
The North Carolina Law Review, Vol 53, No 2, p 303-343, December 1974.

Descriptors: *North Carolina, *Coasts, *Land use, *Shore protection, Environmental control, State governments, Regulation, Administrative agencies, Water resources, Legal aspects, Legislation.

The 1974 Coastal Area Management Act (Act) is a significant piece of legislation for North Carolina. The Act creates a mechanism for coordinated state and local regulation of land and water in the coastal area. This area has been denominated by the Coastal Resources Commission as an area of environmental concern. The formulation of general land use plans are required for each of the twenty coastal counties. The Act is virtually free of legislative direction on the substance of regulatory policy. The reason of the Act's lack of substantive content is that it is difficult to regulate aspects of potential dispute except in broad terms. Lawsuits dealing with the application of the Act to particular land probably will focus on the reasonableness of the regulation or order being contested. The Act mandates a permit system for certain development. Permit denials are likely to result in claims that the underlying regulation constitutes an unconstitutional taking of private property. Such attacks could invalidate the Act or substantially weaken it. (Wilson-Florida)
W80-04963

CONFLICT OF INTEREST RULES APPLICABLE TO WETLAND AGENCY MEMBERS,
C. L. Chambers.
Connecticut Bar Journal, Vol 49, No 1, p 178-188, March 1975.

Descriptors: *Connecticut, *Land use, *Wetlands, Judicial decisions, Administrative agencies, Legislation, Legal aspects, Zoning, Planning, Water policy, Water law, State governments.

The Connecticut Wetlands Act (Act) was amended in 1974 to limit the participation of members of Inland Wetlands agencies in decisions where there is conflict of interest. The amendment prohibits a member of any board or commission from participation in any hearing or decision upon any matter in which he is directly or indirectly interested either personally or financially. This amendment incorporates portions of the conflict of interest provisions in Connecticut statutes governing the disqualification of members of zoning authorities and planning and zoning boards. These statutes reflect the stringent prohibitions of Connecticut's case law in the conflict of interest area. The Act does not prohibit agency members from representing the viewpoint of other commissions where the viewpoint would contribute to balanced decision making. A leading case concludes that any decision as to whether a person's interest will be sufficiently disqualifying is necessarily a factual one which depends on the circumstances of the particular case. Implicitly, the Connecticut decisions appear to rely on a rebuttable presumption that the commissions and boards have acted with fair and proper motives. (Wilson-Florida)
W80-04964

ACID MINE DRAINAGE AND THE PENNSYLVANIA COURTS,
Duquesne Univ. of the Holy Ghost, Pittsburgh, PA. School of Law.
R. Broughton, T. A. Koza, and G. F. Selway.
Duquesne Law Review, Vol 11, No 4, p 495-555, Summer 1973.

Descriptors: *Pennsylvania, *Acid mine water, *Judicial decisions, *Coal mine wastes, Legislation, Coal mines, Legal aspects, Drainage, Constitutional law, Pollutants, Water pollution control, Streams.

In March 16 and April, 1973, Pennsylvania courts issued three decisions relating to coal mine drainage in Pennsylvania. These cases deal with major federal constitutional issues, and with some of the most critical technical and philosophical problems of any mine acid pollution control program. The discharge of acid mine drainage into already polluted waters was prohibited in Pennsylvania by the 1965 Clean Streams Law which was amended in 1970. In the Pittsburgh Coal and Harmar Coal cases, the Supreme Court decided that: (1) the Clean Streams Law was applicable to acid mine drainage from inactive as well as active mines; (2) the Clean Streams Law was Constitutional; and (3) there was substantial evidence to support a finding by the Sanitary Water Board. The Barnes and Tucker case involved a discharge from a mine after the mine was sealed. The Commonwealth Court held Barnes and Tucker not responsible for abatement and treatment of this acid mine drainage. (Wilson-Florida)
W80-04966

ENVIRONMENTAL CITIZEN SUITS: THREE YEARS' EXPERIENCE UNDER THE MICHIGAN ENVIRONMENTAL PROTECTION ACT,
Michigan Univ., Ann Arbor.
J. L. Sax, and J. F. DiMento.
Ecology Law Quarterly, Vol 4, No 1, p 1-62, Winter 1974.

Descriptors: *Michigan, *Adjudication procedure, *Water pollution control, Legal aspects, Water law, Land use, Judicial decisions, Pollution abatement, State governments, Legislation, Environmental control.

The Michigan Environmental Protection Act (Act) was the first statute to provide for citizen suits to protect the environment from degradation by either public or private entities. The federal Clean Air Act and Water Pollution Control Amendments, and several state statutes, have followed the Michigan lead. During the first three years since the Act's enactment, 74 cases have been initiated. The broad standing provision in the Act has produced a very diverse set of plaintiffs, local and state agencies, neighboring property owners, taxpayer and citizen groups, and established environmental organizations. One of the more important decisions was Irish v. Green. The plaintiff challenged a proposed housing development on four counts, one of which was that seepage from septic tanks was likely to cause water pollution. The court found for the plaintiff on the water pollution issue, but dismissed claims of wasteful land use and failure to provide an environmental impact statement. The Act has received relatively little substantive interpretation. One encouraging development is the frequency with which public agencies have invoked the Act. (Wilson-Florida)
W80-04967

PRIVATE ACTIONS FOR DAMAGES RESULTING FROM OFFSHORE OIL POLLUTION,
M. M. Gordon.
Columbia Journal of Environmental Law, Vol 2, No 1, p 140-192, Fall 1975.

Descriptors: *Oil spills, *Oil pollution, *Damages, International law, Federal government, State government, Common law, Water pollution, Jurisdiction, Compensation, Public rights.

Oil pollution of coastal and interior waters damages both private and public interests. Federal legislation deters both accidential and intentional discharge, but such legislation is deficient in protect-

ing private interests. Despite this gap in federal coverage, private damage suits are being brought. These suits are examined in the context of the relevant common law and recent developments at the state and international levels. United States jurisdiction extends to all admiralty and maritime cases. Admiralty jurisdiction is invoked when alleged conduct results in a maritime tort. Oil pollution of navigable waters can constitute such a tort. The traditional theories of liability discussed are negligence, private and public nuisance, trespass, unseaworthiness, and strict liability for abnormally dangerous activities. State legislation is classified under four headings. Maine's legislation is the most desirable for the private plaintiff. A board determines third party damages rather than a judicial proceeding in court. Recommendations are offered for legislation to remedy obstacles to recovery for offshore oil pollution. (Daniels-Florida)
W80-04968

LAYING THE FOUNDATION FOR SOPHISTICATED ENVIRONMENTAL STRATEGIES: A FLORIDA CASE STUDY,
Florida Univ., Gainesville.
J. W. Little.
Columbia Journal of Environmental Law, Vol 1, No 1, p 110-146, Fall 1974.

Descriptors: *Florida, *Permits, *Public rights, Legislation, Standards, Environmental effects, Legal aspects, Navigable waters, Preservation, Conservation, Constitutional law.

Two basic routes must be followed to increase the scope of existing environmental protections - public interest litigation and legislation. Public interest proponents have attained a high degree of sophistication in their efforts to expand public control over matters once thought controlled by private interests and government. Also described is how the law was molded through litigation before the sophisticated, strategy-laden environmental law suits of today. Today's public interest efforts are based on these earlier environmental campaigns. A Florida case history is given of the controversial dredging and filling of estuarine areas to demonstrate the development of environmental legal strategies. Local and state proceedings are discussed, involving the right of two small landowners to dredge and fill. The multitude of legal skirmishes clarifies state law and influences much protective legislation. Another factor was a federal ruling which allowed permit denial for dredge and fill based solely on environmental considerations. (Daniels-Florida)
W80-04969

FOREIGN ACCESS TO U.S. FISHERIES IN THE WAKE OF THE FISHERY CONSERVATION AND MANAGEMENT ACT,
G. S. Yarema.
Virginia Journal of International Law, Vol 18, No 3, p 513-567, Spring 1978.

Descriptors: *Fisheries, *Resource allocations, *Foreign countries, *Fish management, Foreign trade, Administrative decisions, Negotiations, Legislation, Conservation, Resources development, Management.

The impact of the 1976 Fishery Conservation and Management Act (FCMA) upon both the traditional and innovative types of foreign involvement in United States (U.S.) managed fisheries is analyzed. The FCMA scheme directly authorizes foreign fishing through international governmental negotiations. There are several contingencies on which such arrangements depend. The distinction that the FCMA draws between foreign fishing and U.S. fishing permits preferential access to the U.S. Zone for U.S. corporate fishing ventures controlled by foreign investors. Legislative proposals to restrict foreign investment in U.S. fishing corporations are discussed. Such measures would not contribute effectively to long-term management of the U.S. zones' resources, or serve the interests of important sectors of the domestic fishing industry. The application of FCMA to the purchase of the U.S. catch at sea by foreign-flag factory vessels under joint venture agreements is explored. The Department of Commerce has tried to regulate the allocation of harvested resources, but that effort exceeded the authority delegated by the FCMA. (Daniels-Florida)
W80-04970

THE LAW OF THE SEA AND REGIONAL FISHERIES POLICY,
South Pacific Commission, Noumea (New Calidonia).
R. E. Kearney.
Ocean Development and International Law Journal, Vol 5, No 2/3, p 249-286, 1978. 1 Fig, 6 Tab, 43 Ref.

Descriptors: *Law of the Sea, *Marine fisheries, *Fish management, *International waters, United Nations, Fisheries, Fish migration, Fish conservation, Regional development, Fish harvest, Resources development, Pacific Ocean.

The consequences of the inevitable acceptance of extended jurisdiction and its impact on fisheries policy in the South Pacific are considered within the framework of the principles outlined at the Third Session of the United Nations Law of the Sea Conference. The region's fisheries resources are dominated by highly migratory species, particularly tunas. The management of the fisheries on these species and the conservation of the species will require comprehensive regional cooperation. A regional fisheries agency is considering the required to protect the common interests of the region's developing countries which are inexperienced in fisheries management and in surveillance and enforcement capabilities. A wide range of possible functions of such a body is discussed, and a three-phase approach to the development of the agency is proposed. (Schwerer-Florida)
W80-04971

TRANSIT RIGHTS AND U.S. SECURITY INTERESTS IN INTERNATIONAL STRAITS: THE 'STRAITS DEBATE' REVISITED,
Pittsburgh Univ., PA.
C. E. Pirtle.
Ocean Development and International Law Journal, Vol 5, No 4, p 477-497, 1978.

Descriptors: *United States, *Straits, *Law of the Sea, *Military aspects, Oceans, Access routes, Transportation, Negotiations, International waters, Economic impact, United Nations, Navigation.

The issue of transit rights through international straits overlapped by an extension of territorial seas to 12 miles was the focal point of intense debate between the United States (U.S.) and strait states during the formative stages of the Third United Nations Law of the Sea Conference. Even though the Informal Composite Negotiating Text provisions on transit through straits reflect basic U.S. navigation and security interests. The issue of transit rights through straits is not a dead issue. Straits states may refuse to ratify a Law of the Sea treaty incorporating ICNT provisions on transit passage, or attempts to obtain a comprehensive LOS treaty may end in failure. In either case, the United States may be forced to accept a right of innocent passage through international straits. Transit security will be determined by political rather than legal considerations. U.S. security interests in the straits are not undermined by a right of innocent passage. (Schwerer-Florida)
W80-04972

AREA OF ORIGIN STATUTES - THE CALIFORNIA EXPERIENCE,
California State Dept. of Water Resources, Sacramento.
R. B. Robie, and R. R. Kletzing.
Idaho Law Review, Vol 15, No 3, p 419-441, Summer, 1979.

Descriptors: *California, *Water distribution(Applied), *Water supply, *Water transfer, State governments, Water works, Water policy, Water deliver, Water resources development, Wild river act, Water shed management, Water shortage.

As a result of unevenly distributed water supplies and water shortage problems in rapidly growing areas, several interregional water transfers have been implemented in California. Area of origin laws provide both an economically feasible source of water for transfer and protection to originating areas. Examined are the major water transfer acts effective in California, and the history of the nearly half-century old County of Origin and Area of Origin Acts. The application of these acts to the construction and operation of the California State Water Project is considered. The area of origin law affects the State Water Project in two ways. First, protected areas are given certain preferential rights to contract for water. Second, certain rights are given to construct projects or make diversions without being subject to the prior rights acquired under state application for the State Water Project. Recent federal and state statutes providing additional protection to areas of origin are also discussed. (Schwerer-Florida)
W80-04973

JUDICIAL REVIEW OF EPA ACTION UNDER THE CITIZEN SUIT PROVISION,
J. H. Chu.
Columbia Journal of Environmental Law, Vol 3, No 2, p 262-305, Spring 1977.

Descriptors: *Federal Water Pollution Control Act, *Administrative decisions, *Judicial decisions, *Water quality standards, Administrative agencies, Legislation, Reviews, Standards, Environmental effects, Legal aspects, Water pollution control.

Congress recognized the need for judicial review of administrative decisions affecting environmental concerns. Two statutory provisions in recent major federal pollution control legislation authorize judicial review of specified actions taken by the Administrator of the federal Environmental Protection Agency. One such provision allows for citizen suits against the Administrator where there is alleged failure to perform any nondiscretionary act or duty. The jurisdiction of each provision as interpreted by the courts is clarified. Expansion of the citizen suit jurisdiction is suggested. The present judicial test for establishing jurisdiction limits the citizen suit provision. Citizen suits have been limited by the courts to compelling the Administrator to act when he has breached a nondiscretionary act, and have been precluded from review of any abuse of discretion by the Administrator. A more rigorous standard of review is advocated. (Daniels-Florida)
W80-04974

SOME IMPLICATION OF OCEAN RESEARCH,
Washington Univ., Seattle.
W. S. Wooster.
Ocean Development and International Law Journal, Vol 4, No 1, p 39-50, 1977.

Descriptors: *Research and development, *Upwelling, *Law of the Sea, Political aspects, Oceans, Foreign countries, Research priorities, Economic justification, Research facilities, Scientific personnel.

Modern ocean research is more expensive than many laboratory sciences partly because of the costly research vessels required for field work. Funding for ocean research is justified on the basis of expected benefits. Such research also has political implications relating to the law of the sea and to the transfer of technology. Some of these implications can be illustrated in an analysis of upwelling research. Upwelling is an oceanic process of vertical flow and mixing that occurs on eastern sides of the Atlantic and Pacific Oceans and along the equator, among other locations. Potential benefits include predicting fishery yields, forecasting weather and climate, and locating and assessing nonliving resources. Because of the location of coastal upwelling, many developing countries are concerned with sharing in these benefits. This concern has affected negotiations over control of marine scientific research in the law of the sea negotiations, and is related to the need to develop scientific capability in such countries. (Wilson-Florida)

W80-04975

UNITED STATES POLICY WITH RESPECT TO HIGH SEAS FISHERIES AND DEEP SEABED MINERALS - A STUDY IN CONTRACTS,
L. W. Finlay.
Natural Resources Lawyer, Vol 9, No 4, p 629-643, 1976.

Descriptors: *Fisheries, *Beds under the sea, *Law of the Sea, *International law, United Nations, Conferences, Mining, Fishing, Oceans, International commissions, Treaties, Jurisdiction, *Beds under water.

Two important points are considered regarding the impact of the on-going deliberations in the Third United Nations Conference on the Law of the Sea on United States (U.S.) high seas fisheries and deep seabed minerals policies. First, proposals must be regarded as the views of individual states, rather than principles of existing law. Second, the convention will not create new international law for non-participating states. Exclusive coastal state fisheries jurisdiction to the 12 mile offshore is now generally accepted principle of international law. However, as the International Court of Justice decided in the Fisheries Jurisdiction Case, a coastal state may not take matters exclusively into its own hands in the determination of its preferential fishing rights. With respect to seabed resources, customary international law confirms the exclusive jurisdiction of coastal states over the seabed resources within their continental margins. (Wilson-Florida)
W80-04976

INNOVATIVE PROGRAMS AND PROPOSALS FOR THE RECONCILIATION OF PRIVATE AND PUBLIC INTERESTS IN THE CALIFORNIA COASTAL ZONE,
Nossaman, Waters, Krueger, Marsh and Riordan, Los Angeles, CA.
L. L. Marsh.
Natural Resources Lawyer, Vol 10, No 2, p 257-278, 1977.

Descriptors: *California, *Public rights, *Shore protection, *Land use, Land management, Regulation, State governments, Decision making, Judicial decisions, Equity, Urbanization, Legal aspects.

Urbanization problems are particularly acute in California's coastal zone. Reaction to these problems has spawned land use legislation at both the federal and state levels. The significant issue involved in land use management systems is the proper rule of private interests and the various governmental agencies representing public interest at the local, regional, state and federal levels. A few innovative proposals and suggestions for reconciling public and private interests in the coastal zone are focused on. The historic development of the private property concept and of government land use regulation is traced. The coordination of government planning and permit processing is discussed. The coordination process involves interagency cooperation in planning and permit processing. Procedures and arrangements provided for the reconciliation of public interests are also important to private interests. Historically, private interests were relied on to make land use decisions. Present problems demand modification of that system. Land use management systems must reconcile public and private interests and recognize the proper role of each. (Daniels-Florida)
W80-04977

ADDITION TO THE ANNUAL REVIEW OF SIGNIFICANT LEGISLATIVE, ADMINISTRATIVE AND JUDICIAL ACTIVITIES DURING 1976: WATER QUALITY COMMITTEE.
American Bar Association, Washington, DC. Natural Resources Section. Water Quality Committee.
Natural Resources Lawyer, Vol 10, No 2, p 297-322, 1977.

Descriptors: *Federal Water Pollution Control Act, *Judicial decisions, *Administrative decisions, Regulation, Permits, Legislation, Administrative agencies, Legal aspects, Water pollution control, Water law.

In 1976 no significant or substantive changes were made in the Federal Water Pollution Control Act (FWPCA); Safe Drinking Water Act; or the Marine Protection, Research and Sanctuaries Act. The federal Environmental Protection Agency (EPA), which administers these acts, promulgated a broad body of important regulations in 1976. A large number of significant judicial decisions interpreting the FWPCA's requirements were rendered in 1976. These administrative and judicial decisions are discussed. The EPA administrative decisions concerned (1) Secondary Treatment of publicly-owned treatment works; (2) Effluent limitation guidelines and new source performance standards for industrial point sources; (3) Toxic pollutant effluent standards; (4) Pretreatment; (5) Oil and Hazardous Substances; (6) Marine Sanitation devices; (7) Thermal discharges; (8) Dredged or fill material; and (9) the NPDES permit program. The judicial decisions between January 31, 1976 and February 23, 1977, shows trends and inconsistencies between cases. Principle emphasis is on cases involving the central regulatory and enforcement provisions of Title III or the permit provisions of Title IV of the FWPCA. Cases involving oil spill and citizen suit provisions are reviewed. Cases concerning the sewage treatment facility grant program of Title II are not reviewed. (Daniels-Florida)
W80-04978

COAL SLURRY TRANSPORTATION SYSTEMS AND RELATED WATER RIGHTS AND WATER QUALITY PROBLEMS,
International Paper Co., Mobile, AL.
W. Kiechel, Jr.
Natural Resources Lawyer, Vol 11, No 3, p 411-417, 1979.

Descriptors: *Legal aspects, *Watersupply, *Coal, *Transportation, Legislation, State governments, Environmental effects, Navigable waters, Watershed management, Judicial decisions, Political constraints.

Coal slurry pipelines offer a number of advantages today. Coal and water are the two basic ingredients for a coal slurry pipeline. Problems of legal availability of water is the critical issue with respect to coal slurry pipelines. While the areas where coal originates seek expanded coal usage, they are hostile to exporting water to transport the coal. Legal and political problems arise from the diversion of water from one watershed to coal slurry pipelines. The reserved rights doctrine of water law and its amenability to coal slurry pipeline use are considered. Two concepts limit the doctrine's use for coal slurry pipeline purposes. Other sources of water supply are navigable waters, federal reclamation projects or other multipurpose federal projects. Another key issue in the feasibility of a coal slurry pipeline is the crossing of railroad right-of-ways. There is proposed federal legislation that would grant the right of eminent domain to pipelines. Coal slurry pipelines should be considered. (Daniels-Florida)
W80-04979

THE COASTAL ZONE MANAGEMENT ACT AND ITS POTENTIAL IMPACTS ON COASTAL DEPENDENT ENERGY DEVELOPMENT,
McCutchen, Black, Verleger and Shea, Los Angeles, CA.
H. J. Privett.
Natural Resources Lawyer, Vol 11, No 3, p 455-505, 1979.

Descriptors: *Coasts, *Shore protection, *Land use, Management, Regulations, State government, Federal government, Programs, Legal aspects, Resource development, Legislation.

The effect of the 1972 Coastal Zone Management Act (Act) on the development and content of state coastal management programs is analyzed. Prior to their approval, it is important that state programs comply with the Act. Interim final regulations, published on March 1, 1978, revised and superseded several prior regulations regarding development and approval of state coastal management programs. The more significant aspects of the new regulations are discussed in an issue by issue analysis of the Act's procedural and substantive requirements. Two novel concepts of general application are introduced by the regulations. First, a 'refinement' procedure exempts procedural changes to approved programs from the requirements of the Act which apply to program amendments. Second, states are authorized to include unenforceable enhancement policies in their management programs. The second concept runs directly counter to the requirement that programs be enforceable. The procedural requirements relate to program development, design, adoption and implementation. The substantive requirements include specific provisions that state programs must contain. The Twelve major substantive requirements are set forth and discussed. (Daniels-Florida)
W80-04980

MARICULTURE, THE LAW OF THE CONTINENTAL SHELF AND OFFSHORE OIL RECOVERY: A TECHNOLOGY AFFECTED BY A BODY OF LAW EFFECTED BY A TECHNOLOGY,
M. E. Shirley.
Natural Resources Lawyer, Vol 11, No 4, p 725-753, 1979.

Descriptors: *Marine fisheries, *Continental shelf, *Aquaculture, *Law of the Sea, Technology, Oceans, Oil platforms, Marine animals, Fishing, Fish farming, National seashores, Oceanography.

Recent developments in offshore oil and gas technology and deep ocean mining have led to the necessity for reviewing and perhaps redrafting various aspects of the law of the sea. In order to bring a higher degree of rationality to government policy-making with regard to these developments, there is a need for closer interaction between science, technology and law. Topics explored in this article are: (1) the impact of the technology of offshore oil recovery upon the law of the continental shelf; (2) the development of the law of the sea to date and short-term forecasts; and (3) the impact of the law thus developed upon mariculture, as yet a relatively unrelated technology. The legal boundaries established in response to the growth of offshore oil recovery will determine the legal regime in which the infant industry of mariculture will develop its technology. Further analyzed are legal developments in coastal laws and their application to the formulation of new ocean-use rules and regulations governing manmade mariculture stations at sea. (Schwerer-Florida)
W80-04981

DEVELOPMENT OF THE RIO GRANDE COMPACT OF 1938,
R. A. Hill.
Natural Resources Journal, Vol 14, No 2, p 163-200, April 1974.

Descriptors: *Rio Grande River, *Water supply development, *Water contracts, Water supply, Water allocation, Water policy, Irrigation water, Allotments, Water users, *Interstate compacts, Colorado, New Mexico, Texas.

The 1938 Rio Grande Compact (1938 Compact) was entered into by Colorado, New Mexico and Texas. It was designed to provide maximum beneficial use of water in the Rio Grande basin above Fort Quitman, Texas, without impairing any previous supplies beneficially used. The history of the 1938 Compact is reviewed. Long before 1938, it was obvious that quantities of water obtainable for the Rio Grande were not sufficient to meet the area's irrigation demands. In 1926, the federal government undertook a study to develop a program to rehabilitate the Middle Rio Grande Valley. The reaction to this program was adverse by water users in Colorado, Texas, and New Mexico who feared any expansion of upstream use would impair their water supply. This led to the Rio Grande Compact of 1929. The 1938 Compact was an expansion of the 1929 Compact. The provisions of the 1938 Compact are analyzed, including a clarification of its meaning and intent. (Daniels-Florida)

W80-04982

OBSTACLES TO GEOTHERMAL DEVELOPMENT,
For primary bibliographic entry see Field 5C.
W80-04983

USE OF THE WATERS OF THE COLORADO RIVER IN MEXICO: PERTINENT TECHNICAL COMMENTARIES,
I. L. Cabrera.
Natural Resources Journal, Vol 15, No 1, p 27-34, January 1975.

Descriptors: *Colorado River basin, *Water quality, *Salinity, *Mexico, *United States, Colorado River, Colorado River Compact, Treaties, Water resources, Water users, Agriculture, River basins, Riparian waters.

The Colorado River Basin spreads over both Mexico and the United States. A valley was formed by the river, of which the two countries each own half. It is prime agricultural land and each country uses the river to irrigate it. The United States gained control of the river and a treaty was signed in order to clearly fix Mexico's rights. Although this treaty guarantees a certain quantity of water to Mexico, it says nothing of quality. A salinity problem developed and highly saline groundwater was being pumped to Mexico as part of its allotment. The United States argued no violation of the treaty, but the treaty refers to the water used by each country as being equal. The United States argued that the situation was a result of a reasonable use of the waters within its territory, but the assumptions it made were not totally sound. After much negotiation, the United States promised to take measures to guarantee that the waters turned over to Mexico would be of permanently acceptable quality. (Tabano-Florida)
W80-04985

THE COLORADO RIVER SALINITY AGREEMENT OF 1973 AND THE MEXICALI VALLEY,
Arizona State Univ., Tempe.
D. B. Furnish, and J. R. Ladman.
Natural Resources Journal, Vol 15, No 1, p 83-107, January 1975.

Descriptors: *Colorado River, *Salinity, *Mexico, *United States, International law, Water users, Irrigation water, Water quality, Water delivery, Governmental interrelations, Treaties, International waters.

The most troublesome aspects of the 1973 Colorado River Salinity Agreement (Agreement) and their ramifications for United States (U.S.) - Mexican relations and international law are examined. The river is of major economic importance to Mexico as it provides irrigation for agriculture in nearby valleys. An historical overview is presented of the river's use and the dealings between the two countries concerning its use. The genesis of the Agreement is examined. All the Agreement accomplishes is that the U.S. has a duty to deliver water of usable quality across the border. Despite confidence in the Agreement, there is no absolute definition of the allowable salinity level. There are also potential delivery problems to the San Luis Valley. There also may not be sufficient water to allow for all consumptive uses. The U.S. has offered nonreimbursable assistance for improvement and rehabilitation. Implementing legislation for the Agreement is considered. The Agreement is insufficient to avoid future controversy and a new treaty may need to be negotiated. (Tabano-Florida)
W80-04986

FISHERY CONSERVATION AND THE LAW OF THE SEA.
In: Proceedings of the Seventy-Second Annual Meeting, April 27-29, 1978, Washington, D.C. the American Society of International Law, p 321-343, 1978. ASIL, Washington, D.C.

Descriptors: *Law of the Sea, *Fish management, *Fish conservation, *Marine fisheries, Fish, International commissions, United Nations, Oceans, Fishing, Resources, Marine animals, Fisheries.

The United Nations Conference on the Law of the Sea has had limited success, despite two separate redraftings of its negotiating text. The Law of the Sea negotiations began several years ago with early emphasis on developing an acceptable international regime for fisheries conservation and management. The present negotiating text being used by the Conference gives each coastal state the right to manage and the obligation to conserve all the fish within a 200 mile economic zone. Establishment of United States control over its 200 mile fisheries area and similar action by many other coastal states has produced several problems. One difficulty has been with management of fishermen, both domestic and foreign. In 1976, Congress passed the Fishery Conservation and Management Act, giving the United States jurisdiction over all fish except tuna within its 200 mile economic zone. The Law of the Sea negotiations have provided a good framework for establishing regimes for fisheries conservation and management throughout the world. In addition lesser known resources, such as krill, may become the world's major fishery product. Studies for the exploitation and management of these resources should be undertaken in the future. (Wilson-Florida)
W80-04987

A THEORETICAL ANALYSIS OF MINUTE 242,
New Mexico Univ., Albuquerque.
A. V. Kneese.
Natural Resources Journal, Vol 15, No 1, p 135-140, January 1975.

Descriptors: *Colorado River, *Salinity, *International waters, *Economic justification, International law, Economics, Governmental interrelations, Benefit sharing, Compensation, Water law, United States, Mexico.

The 1973 Colorado River Salinity Agreement is examined from an economic point of view. Four types of situations are presented which seem to characterize most cases involving international watercourses: (1) pure 'public goods' situations; (2) situations where upstream development provides benefits for both upstream and downstream countries; (3) the 'common property' situation; and (4) the 'zero sum situation'. The situation between the United States and Mexico is viewed as a 'zero sum' situation. This means that the water use by an upstream country diminishes the benefit to the downstream country, but the downstream user cannot retaliate in any direct way. In this situation, there can be no basis for agreement unless the victum country compensates the damaging country for costs incurred to reduce the damage. In this Agreement, however, the United States has agreed to pay the entire cost of mitigating the damage. Extraneous considerations must have been dominant in the decision, most notably the projection of a proper national image. This Agreement will not be the final word on the matter. (Tabano-Florida)
W80-04988

NEW MEXICO'S NATIONAL FORESTS AND THE IMPLIED RESERVATION DOCTRINE,
R. A. Marquez.
Natural Resources Journal, Vol 16, No 4, p 975-1002, October 1976.

Descriptors: *New Mexico, *Reservation doctrine, *Federal-state water rights conflicts, Judicial decisions, Forest management, Federal government, State government, Forests, Water rights, Administrative agencies, Prior appropriation.

There is a great federal-state conflict over the waters of the western United States. The source of conflict is the implied reservation doctrine which vests water rights in the federal government. The principal federal agency affecting New Mexico water rights is the Forest Service. The New Mexico State Engineer has steadily attacked the implied reservation rights claimed for New Mexico's National Forests. Both the State Engineer and the Forest Service claim a better right to use of the water, an increasingly scarce and valuable resource. A reserved federal water right has certain characteristics incompatible with state appropriation water law: (1) created without diversion or beneficial use; (2) unlost by nonuse; (3) priority-dated from the time of land withdrawal; and (4) measured by the amount of water necessary to satisfy the purposes for which the land has been withdrawn. Perhaps the doctrine's foremost problem is that of compensation. Most of the recommended federal legislation supports some type of compensation for impaired vested uses. (Wilson-Florida)
W80-04989

THE PATRIMONIAL SEA TO THE RESCUE OF THE GULF OF CALIFORNIA,
Universidad Nacional Autonoma de Mexico, Mexico City.
A. Szekely.
Natural Resources Journal, Vol 17, No 1, p 113-122, January 1977.

Descriptors: *Mexico, *Boundary disputes, *Gulfs, *International law, History, Law of the Sea, United States, Bays, Internal waters, International law, Legal aspects, Fishing, *Gulf of California.

During the last twenty years, several sectors of the Mexican community have alleged that the Gulf of California should be regarded as part of the Mexican territory. They have demanded that the government proceed, in the national interest, to close the Gulf. To substantiate these allegations and demands, they have invoked a legal, historic title supported by international law. In 1975, Mexico announced its definite plans to claim a two-hundred mile patrimonial sea or exclusive economic zone. This measure would have the logical and immediate effect of closing the Gulf of California to foreign fishermen. Under the provisions of the 1958 Geneva Convention, the Gulf of California is considered a geographical bay. Because the imaginary line drawn across the mouth of the Gulf measures approximately 110 miles, it cannot be regarded as internal waters of Mexico. Many Mexican jurists have argued that the Gulf was a Mexican 'historic bay'. Mexico's claim to the Gulf of California has actually been affected more by internal differences than by external influences. (Wilson-Florida)
W80-04990

THE PRESSURE FOR SHORELINE DEVELOPMENT: SPATIAL CONCEPTS IN REVIEW,
Ottawa Univ. (Ontario).
P. Harrison.
Coastal Zone Management Journal, Vol 3, No 3, p 319-322, 1977.

Descriptors: *Washington, *Public access, *Coasts, *Shore protection, Public benefits, Sea shores, Ecosystems, Resources development, Environmental effects, Ecology, Developed waters.

The complex structure of the coastal ecological system creates certain delicate subzones that have little if any regenerative capacity. Shallow, easily stratefied waters are less capable of coping with the impact of human development than more open turbulent waters. The calibration of carrying capacities of coastal systems is a difficult and as yet unclear process. Certain generalizations can be made. First, high-density, nodul development is generally unsuited to coastal areas of low carrying capacity and to areas of high capacity extremely limited in extent. Second, low-density or spread development would seem to be a significant underutilization of high carrying capacity areas. Spread development tends to preempt public access, by closing off shoreline use to all except a small group of owners. Public access is related to environmental carrying capacity. Excessive access to ecologically delicate areas is perhaps the best way to promote environmental degradation. (Wilson-Florida)
W80-04991

A GENERAL INTERNATIONAL LAW DOCTRINE FOR SEABED REGIMES,
Syracuse Univ., NY.

L. F. E. Goldie.
International Lawyer (A.B.A.) Vol 7, No 4, p 796-824, October 1973.

Descriptors: *Oceans, *Mining, *Beds under water, *Law of the Sea, International law, Underwater, Regime, Exploitation, Governments, United Nations, Common law, Claims.

Various proposals for seabed regimes, methods to manage international seabeds are compared with general international law governing deep seabed mining activities. Decisional law is examined regarding concepts of possessory rights under international law. Cases from Anglo-American common law illustrate the misleading effects caused by stressing the need for a specific, immediate and active control to establish possession. The common law development of miner's rights is discussed, focusing on the practices in the American west. Similar practices arising in international law are appraised. The concept of acquired rights is discussed. The United Nations' Moratorium resolution and common heritage clause are examined in relation to general international law. The relations of seabed - exploitating enterprises operating under laws of different states are examined, as are the relations between two or more American enterprises in international seas. (Daniels-Florida)
W80-04992

INTERNATIONAL CONTROL OF DUMPING AT SEA,
G. J. Timagenis.
Anglo-American Law Review, Vol 2, No 2, p 157-187, April-June 1973.

Descriptors: *Law of the Sea, *Waste disposal, *International commissions, International law, International waters, Internal water, Wastes, Water pollution control, Coasts, Legal aspects, Oceans.

The conventional rules, judicial precedents, and general principles of international law of the sea are clearly inadequate to meet the problems raised by waste disposal at sea. Traditional international law has dealt with waste disposal in two contexts: (1) territorial sea and internal waters; and (2) high seas and contiguous zones. States have sovereignty in the territorial sea areas, subject to the rules of international law. A state has the right to dispose of waste material in the high seas, 'with reasonable regard to the interests of other states.' The 1969 International Legal Conference on Marine Pollution Damage in Brussels adopted a resolution recommending that work be intensified on all aspects of pollution other than oil. The 1972 United Nations Conference on the Human Environment in Stockholh adopted recommendations for future action for the preservation and improvement of the environment. The first regional convention dealing with dumping was signed in Oslo in 1972 by twelve European countries. The United States initiated efforts in 1971 for an instrument to control ocean dumping. (Wilson-Florida)
W80-04993

A COMPREHENSIVE OIL POLLUTION LIABILITY AND COMPENSATION ACT: HOW SUPER IS THE 'SUPER FUND',
S. J. Tresidder.
Detroit College of Law Review, Vol 1978, No 2, p 277-306, Summer 1978.

Descriptors: *Oil spills, *Compensation, *Oil pollution, *Damages, Economic impact, Water pollution effects, Economic justification, Legislation, International law, Water law, Water pollution control, Oil industry.

In recent years, oil spills have received increasing attention. Massive spills have caused extensive damage and cost millions of dollars. Proposed federal legislation provides for a comprehensive oil pollution liability and compensation program. Rules governing traditional means of compensation for oil spill damage are found in federal maritime statutory and common law. The limitations of traditional recovery methods has led to the proposed statutory modifications. One of the primary purposes of the federal statutory changes has been to alleviate the problems of funding for rapid removal of spilled oil. Oil spill compensation systems have been affected by federal and state legislation, international law, and voluntary agreements. The so-called 'Super Fund' legislation, currently pending in Congress, would create a complete system of oil spill compensation for cleanup costs, damages to third parties, and environmental injury. The 'Super Fund' drawback is its strong potential for losing money. The importance of protecting United States water resources outweighs any potential cost problems. (Wilson-Florida)
W80-04994

LEGAL SYSTEM REQUIREMENTS TO CONTROL AND FACILITATE WATER AUGMENTATION IN THE WESTERN UNITED STATES,
K. S. Danielson, G. W. Sherk, Jr., and L. O. Grant.
The Denver Journal of International Law and Policy, Vol 6, Special Issue, p 511-525, 1976.

Descriptors: *Colorado, *Artificial precipitation, *Water yield improvement, *Weather modification, Legal aspects, State jurisdiction, Appropriation, Atmosphere, Water resources, Water resources development, Watershed management, Water rights.

Problems of water augmentation are twofold. First is the complexity of the weather modification aspect of water augmentation. These fundamental problems are environmental, social, and legal. Second, legal uncertainties concerning water augmentation will necessarily involve the issue of water rights. The different approaches to water ownership in the western United States is examined, with emphasis on a recent Supreme Court of Colorado decision to the question of the ownership of water produced by water augmentation activities. Water augmentation activities include weather modification and watershed management techniques. These techniques will require legal system responses to protect both water rights holders and the general populace. Areas examined regarding legal system requirements include: state claims to water, water for weather modification, water from augmentation, and artificial water. Possible legal system responses are suggested and the legal and political obstacles are analyzed. (Schwerer-Florida)
W80-04995

JUDICIAL REVIEW UNDER FEDERAL POLLUTION LAWS,
Chicago Univ., IL.
D. P. Currie.
Iowa Law Review, Vol 62, No 5, p 1221-1280, June 1977.

Descriptors: *Federal water pollution control act, *Water quality standards, *Judicial decisions, Administrative agencies, Clean Air Act, Legislation, Legal aspects, Permits, Federal jurisdiction, Reviews, Water pollution control.

In an effort to remedy uncertainties in their predecessor statutes, both the Clean Air Act (CAA) and the federal Water Pollution Control Act (FWPCA) were amended in the early 1970's to include explicit provisions for judicial review. Experience has shown that uncertainties persist; the time has come for legislative re-examination. Both statutes are administered by the federal Environmental Protection Agency. Both are extraordinarily complicated. The heart of the FWPCA is a permit system whose administration may be delegated to the states under specified conditions. Section 509(b) of the FWPCA provides for judicial review of certain federal standards and limitations regulating pollution discharges and review of federal action on permits. The FWPCA is silent about judicial review regarding regulation of sewage discharge from vessels and oil discharge, of the decision to allow additional time to comply with emission control standards. The FWPCA and CAA accord with the modern trend allowing direct appellate review of informal rulemaking. Additional review problems occur regarding jurisdiction and standing, due to certain inconsistent, incomplete or ambiguous provisions. (Wilson-Florida)
W80-04996

STATE AND LOCAL WETLANDS REGULATION IN THE COURTS: CONSTITUTIONAL PROBLEMS ON THE WANE,
S. M. McCraw.
Harvard Environmental Law Review, Vol 1, p 496-514, 1976.

Descriptors: *Wetlands, *Constitutional law, *Land use, Judicial decisions, Legal aspects, Legislation, Regulation, State governments, Ecology, Water law, Economic justification.

Two recent decisions represent emerging judicial acceptance of state wetlands regulation. Plaintiffs in both cases attacked the constitutionality of state wetlands statutes on the grounds that they allowed a taking of private property without just compensation. The two decisions are valuable precedents for upholding wetlands regulation based on reasoning that recognizes the ecological crisis caused by unchecked wetlands development. These two cases, in conjunction with other recent wetlands decisions, indicate potential strategies for legislators and litigants concerned with wetlands protection. A review of recent wetlands cases demonstrates the desirability of drafting wetlands regulations expecting future court challenges. The most important feature of a statute or ordinance in this regard is an introductory statement recognizing the economic value of unaltered wetlands, wetlands ecological functions, and their interrelation with other environmental elements. Added to this introductory statement should be a declaration of state policy to place wetlands regulation under state police power. (Wilson-Florida)
W80-04997

COASTAL ZONE MANAGEMENT AND STATE-LOCAL RELATIONS UNDER THE LOUISIANA CONSTITUTION OF 1974,
Washington, Univ., Seattle.
M. J. Hershman, and M. M. Mistric.
Loyola Law Review, Vol 22, No 1, p 273-300, Winter 1975-76.

Descriptors: *Louisiana, *Coastal marshes, *Shore protection, *Constitutional law, State governments, Estuaries, Coasts, Legal aspects, Legislation, Administrative agencies, Federal project policy, Local governments.

Conservation of Louisiana's extensive coastal marshes and estuaries has been receiving increased attention by the Louisiana legislature in the past six years. In 1974, the Governor designated the State Planning Office to receive the first of three annual planning grants, under the 1972 federal Coastal Zone Management Act, to develop a state coastal management program. With the adoption of the 1974 Louisiana Constitution, which provides for increased autonomy of local government from the state legislature, certain local government leaders challenged the state's power to adopt a coastal management program which is binding on home rule charter governments. There are three articles in the 1974 Constitution which relate to the state's power to implement coastal zone management (CZM) legislation. Article III, Section 1 vests in the state legislature all legislative power not specifically prohibited by the Constitution. Article XIX, Section 18, provides that the police power shall never be abridged. Article IX, Section 1, provides that state natural resources shall be protected by the state legislation. These provisions arguably answer local government officials seeking local insulation from state CZM programs. (Wilson-Florida)
W80-04998

ENVIRONMENTAL LAW,
Jones, Walker, Waechter, Poitevent, Carrere and Denegre, New Orleans, LA.
S. O. Buckley, III.
Loyola Law Review, Vol 24, No 3, p 341-359, Summer 1978.

Descriptors: *Judicial decisions, *Federal Water Pollution Control Act, *Administrative agencies,

Legislation, Clean Air Act, Federal government, Federal jurisdiction, Legal aspects, Water pollution control, Environmental control, Water quality.

The decisions rendered by the Fifth Circuit during the 1977-78 term, reflect the growth and evolution of federal environmental legislation. In recent years, the vast majority of environmental issues have been decided under the 1969 National Environmental Policy Act (NEPA). The NEPA preceded the plethora of specific federal legislation that now covers air, water, solid waste disposal, and other activities. The three NEPA decisions rendered by the Fifth Circuit involved an initial federal agency determination that an environmental impact statement was not required. The Fifth Circuit also analyzed four cases involving the Federal Water Pollution Control Act and amendments thereto. These cases covered the entire spectrum of federal Environmental Protection Agency (EPA) authority from the agencies permit authority to its enforcement responsiblity once permits have been granted. In general, these cases demonstrated a tendency of the Fifth Circuit to defer to the EPA's interpretation of its authority and responsibility under the FWPCA. (Wilson-Florida)
W80-04999

ADMINISTRATIVE WATER RIGHTS INSPECTIONS IN CALIFORNIA,
W. D. Cunningham, and S. J. Imperati.
University of California, Davis, Law Review, Vol 12, No 1, p 105-124, March 1979.

Descriptors: *Water rights, *Inspection, *California, Legal aspects, Water resources, Water demand, Administrative agencies, Regulation, Appropriation, Legislation, Water law.

The ability to enter on private property to conduct water rights inspections is essential to the proper administration of California's water rights scheme. Without it, the State Water Resources Control Board would be unable to perform its statutory duties. The Board's Division of Water Rights receives much voluntary cooperation from most water rights holders. A problem may arise when water rights holders deny Board inspectors access to their private property. Such refusal raises several questions regarding the legality of any subsequent Board entry: (1) whether the Board has the power to enter and make nonconsensual water rights inspections; (2) whether the Board can make these inspections without an administrative inspection warrant; and (3) whether the Board has the authority under the California Code of Civil Procedure to obtain an inspection warrant if one is required. Although California courts have yet to address any of these questions, they cannot avoid dealing with them in the near future. (Wilson-Florida)
W80-05000

CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER.
Law and Policy in International Business, Vol 6, No 2, p 575-586, Spring 1974.

Descriptors: *International law, *Waste disposal, *Law of the Sea, *International waters, Wastes, Water pollution, Water pollution control, Treaties, Political aspects, Pollution abatement, Oceans.

Ocean dumping is not presently a serious problem, but will be in the near future. Because of this threat, the United States submitted a draft convention to the Intergovernmental Working Group on Marine Pollution. The convention is designed to improve the marine environment's quality by prohibiting the dumping of hazardous substances and by regulating the dumping of potentially dangerous materials. Other sources of marine pollution are left to later conventions. The problems and advantages of dealing with marine pollution on a piecemeal basis are discussed. The convention's effectiveness in preventing marine pollution is explored. The effectiveness is hard to predict, dependent on a variety of factors. The most serious shortcoming of the convention is the lack of an effective international enforcement mechanism. The economic effects of the convention are briefly examined. Although the terms of the convention are relatively weak, it is a first step toward the international control of marine pollution. (Daniels-Florida)
W80-05001

LAW OF THE SEA: ITS IMPACT ON THE INTERNATIONAL ENERGY CRISIS,
Ad Hoc Committee on Mineral Resources Beneath the Seas, Washington, DC.
L. W. Finlay, and M. S. McKnight.
Law and Policy in International Business, Vol 6, No 3, p 639-676, Summer 1974.

Descriptors: *Law of the Sea, *International law, *Energy, *Oil industry, Oil, United Nations, Conferences, Navigation, Environmental effects, Beds under water, International Commissions.

The Third United Nations Conference on the Law of the Sea convened in Caracas on June 20, 1974. The delegates were fully cognizant of the enormous impact of current energy shortages arising out of the Arab oil embargo. The most important topics discussed at the Conference affecting the energy crisis were: (1) the breadth of the territorial sea and the related question of the right of unimpeded passage through straits and archipelagic waters used for international navigation; (2) coastal state jurisdiction over seabed resources beyond the territorial sea; (3) deepwater ports; (4) preservation of the marine environment and liability for damages resulting from its use; (5) the regime for the international seabed area; and (6) activities pending the entry into force of a possible treaty. An equitable resolution of the procedural issues facing the Conference will be a critical determinant of its success, as will be the objectivity of the individual conferences in resolving the substantive issues. (Wilson-Florida)
W80-05002

FISHERIES JURISDICTION-UNITED STATES FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976, PUBLIC LAW 94-265, 94TH CONGRESS, H.R. 200,
J. Dorsey.
Harvard International Law Journal, Vol 18, No 1, p 177-185, Winter 1977.

Descriptors: *Fish management, *Fish conservation, *Marine fisheries, *Law of the Sea, United States, International law, United Nations, Fisheries, Legislation, Conferences, Anadromous fish, Jurisdiction.

On the authority of the 1976 Fishery Conservation and Management Act (Act), the United States (U.S.) will extend its fishery jurisdiction to 200 miles from the baseline from which the territorial sea is measured. The extension of the exclusive fishery jurisdiction to 200 miles is part of a comprehensive plan to establish effective conservation and management of U.S. marine resources. The plan is designed to first conserve and subsequently increase the fish yield and marine life in the exclusive fishery zone. The negotiating team from the executive branch which represented the U.S. at the Third Conference on the Law of the Sea led the fight in Congress against the unilateral extension over fisheries jurisdiction. Their principle concern was the effect the Act would have on U.S. negotiating leverage at the Conference. The Act does seem to be in accord with the developments at the Conference, best reflected by the Revised Single Negotiating Text. President Ford expressed his concern as to whether the U.S. has the right under international law to control anadromous species outside its own contiguous zone. (Wilson-Florida)
W80-05003

UNITED STATES OCEANS POLICY: PERSPECTIVE 1974,
Louisiana State Univ. Law Center, Baton Rouge.
H. G. Knight.
Notre Dame Lawyer, Vol 49, No 2, p 241-275, December 1973.

Descriptors: *Law of the Sea, *Oceans, *United States, *Resource allocation, United Nations, International law, Beds under water, Foreign countries, Fisheries, International commissions, Research and Development, Environmental control.

The United States (U.S.) has developed elements of a national oceans policy which it seeks to implement through agreements to be reached at the Third United Nations Conference on the Law of the Sea. There are five basic subject matter areas which this nation is presently emphasizing through its policy proposals: (1) the regime which will govern exploration for and exploitation of the non-living resources of the seabed and subsoil. United States policy regarding coastal state jurisdiction over non-living seabed resources supports the economic resource zone concept. On the question of resources beyond national jurisdiction, U.S. policy favors an international regime; (2) the management of living marine resources. The U.S. acknowledges the state right to extend its fisheries jurisdiction; (3) Territorial Sea-U.S. policy has reflected a desire for a free flow of commerce; (4) Scientific Research - U.S. policy favors freedom of research in the oceans; and (5) Protection of Marine Environment - the U.S. has pressed for international agreements to handle various pollution problems. (Wilson-Florida)
W80-05004

FEDERAL CONTROL OF WETLANDS: THE EFFECTIVENESS OF CORPS' REGULATIONS UNDER SECTION 404 OF THE FWPCA,
J. M. Frasca.
Notre Dame Lawyer, Vol 51, No 3, p 505-521, February 1976.

Descriptors: *Wetlands, *Dredging, *Federal Water Pollution Control Act, Water pollution control, Administrative agencies, Judicial decisions, Jurisdiction, State governments, Legislation, Agriculture, Regulation.

Section 404 of the Federal Water Pollution Control Act Amendments (FWPCA) gives the United States (U.S.) Army Corps of Engineers (Corps) primary authority to regulate dredge and fill operations in 'navigable waters' of the U.S. Section 502(7) of the FWPCA defines the term 'navigable waters' as waters of the U.S., including the territorial seas. As late as April 1975, however, the Corps' regulations restricted its authority to only those waters subject to inundation by tidal waters and susceptible to interstate commerce. In 1975, the federal District Court for the District of Columbia decided the Corps' regulations were in derogation of its statutory duties. The Corps published new regulations which dramatically expanded that agency's regulatory powers. The most substantial criticism of the Corps' section 404 jurisdiction is based on its anticipated adverse impact on agriculture. Moreover, section 404 of the FWPCA was not initially enacted for the specific purpose of wetlands control. The Federal Coastal Zone Management Act has several advantages over FWPCA in this regard. Another serious deficiency of section 404 in wetlands control is the limited state participation. (Wilson-Florida)
W80-05005

DAM POLICY IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
E. R. Kaynor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182835, Price codes: A06 in paper copy, A01 in microfiche. Publication No 110, 1979. 95 p, 1 Fig, 2 Tab, 48 Ref, 2 Append. OWRT-A-113-MASS(1), 14-34-001-8023.

Descriptors: *Dams, *Dam policy, *Massachusetts, *Hydroelectric power, *Riparian rights, *Prior appropriation, Dam safety, Policy, Legal aspects, Governments, Decision making, Jurisdiction.

Massachusetts law contains detailed procedures for compensating those adversely affected by dams. However, court decisions have tended to absolve dam owners from culpability for damages. Massa-

husetts preaches riparian doctrine but practices rior appropriation doctrine. Massachusetts law lso requires dam safety inspections, but inspec- ons seldom occur because there are no funds. ecently, Massachusetts policy has strongly en- ouraged hydroelectric energy production with ery little success in spite of sizeable state and ederal incentives. Survey research reveals that art of the problem is that neither governmental fficials nor the public at large are very interested n dams. There is little knowledge of how to roceed to make beneficial use of dams. There is lso confusion over which governmental level has urisdiction. The Commerce Clause together with iberal definitions of navigability tend to favor ederal jurisdiction, but federal officials try to en- ourage state decision-making except where dams re built or licensed by federal agencies. This eport recommends creation of a Dam Policy De- iberation Committee to further investigate dam unctions and malfunctions in Massachusetts, and o recommend policy changes. It also recommends he creation of a state agency empowered to pur- hase unused, underused, or misused dams for de- velopment according to plans for maximum benefi- cial development. (Godfrey-Mass)
W80-05014

EPA CONSOLIDATION OF PERMITS PROPOSAL-REGULATORY WORKHORSE OR BUREAUCRATIC NIGHTMARE,
Water Pollution Control Federation, Washington, DC.
T. Kish.
Journal Water Pollution Control Federation, Vol 52, No 2, p 229-234, February 1980. 1 Fig.

Descriptors: *Permits, *Regulation, *Waste disposal, Benefits, State governments, Water pollution control, Legislation, Environmental Protection Agency, Administrative agencies.

This paper discussed the benefits and criticisms of proposed regulations aimed at consolidating and unifying procedures and requirements for EPA-administered permit programs to reduce ubiquitous delays. The five programs covered by the proposed regulations are: The Hazardous Waste Management Program; the Underground Injection Control Program; the National Pollutant Discharge Elimination System; the Dredge or Fill Program; and the Prevention of Significant Deterioration Program. Advantages include: environmental benefit, regulatory burden reductions, institutional and resource benefits, and public participation benefits. The proposed single permit form would include a general information section followed by separate sections for each EPA program except the Dredge or Fill Program. The major criticisms, extrapolated from over 5000 pages of written comments, are divided into general, program definitions and basic program requirements, state program requirements, procedures to be followed for making permit decisions, and the consolidated permit form. EPA contends that consolidated permits will provide for a more uniform, comprehensive, and consistent approach to EPA-administered permitting. Hopefully, it will also provide the states with a more uniform and accessible procedure for requesting and assuming permitting responsibility. (Purdin-NWWA)
W80-05037

SHIFTING EMPHASIS TO GROUND WATER,
Water Pollution Control Federation, Washington, DC.
For primary bibliographic entry see Field 5G.
W80-05059

BLACK-LISTING THE POLLUTERS,
Environmental Protection Agency, Philadelphia, PA. Region III.
R. W. Martin, Jr.
Federal Bar Journal, Vol 36, No 1-2,. p 17-29, Winter-Spring 1977.

Descriptors: *Administrative agencies, *Pollution abatement, *Government finance, *Federal Water Pollution Control Act, Administrative decisions, Facilities, Environmental control, Government supports, Administration, Regulation, Federal government.

Pursuant to Section 306 of the Clean Air Act and Section 508 of the Federal Water Pollution Control Act, the Federal Environmental Protection Agency (EPA) can indicate to violators that federal funding may be withheld from their facilities unless there is compliance with the agency's regulations and guidelines. There are six bases upon which a facility may be listed for noncompliance, all indicating some type of court action having been taken against it. A facility might also be listed as ineligible under conditions which do not include a conviction. There is some dispute over this due to unclear legislative history, but the EPA sees its actions as justified. The Office of Federal Activities administers the program. A breakdown of responsibilities within the EPA and the procedure for listing are also set out. The program could be of real value if the EPA moved to ensure that all products come from facilities in compliance. 'National goals clauses' could be put in contracts between the government and facilities to implement this. The procedure has been used twice as of November 1976 against unconvicted violators, and this could be an effective leverage for speedy compliance. (Tabano-Florida)
W80-05067

STATE CONTROL OF OIL POLLUTION: LEGISLATING IN THE TWILIGHT ZONE,
M. Lipeles.
Harvard Environmental Law Review, Vol 1, p 431-457, 1976.

Descriptors: *Oil pollution, *Oil spills, *Federal government, *State governments, Legislation, Constitutional law, Constraints, Compensation, Legal aspects, Cost allocation, Remedies.

Existing federal statutes and common law remedies do not satisfactorily promote the three basic objectives of oil spill liability schemes. As a result, several coastal states have enacted or are considering proposals for oil spill liability and compensation laws. Parallel state and federal developments highlight the oil spill debates most controversial issue of whether the federal government should preempt state authority. This issue raises several questions which should be addressed to resolve the preemption controversy: (1) what constraints does the Constitution impose on state authority over oil spills; (2) what guidelines regarding state action has Congress enacted; (3) what states have done or seek to do regarding spill liability and compensation; and (4) what would be a constitutionally permissable and environmentally sound policy governing state and federal authority. The constitutional, statutory and judicial background to these questions are described. The focus is on current developments at the federal and state levels. It is concluded that Congress should not preempt state oil spill schemes. (Daniels-Florida)
W80-05068

CALIFORNIA'S TIDELANDS TRUST FOR MODIFIABLE PUBLIC PURPOSES,
T. H. Ziemann.
Loyola University of Los Angeles Law Review, Vol 6, No 3, p 485-525, September 1973.

Descriptors: *California, *Public rights, *Seashores, *Shore protection, Preservation, Land management, Environmental effects, Coasts, Ownership of beds, Public lands, Navigation, Fishing, *Tidelands.

The tidelands, that portion of the shore covered and uncovered by the daily ebb and flow of the tides, are an important, if not the key, area of coastal zone land use. California's tidelands are encompassed by the tidelands trust doctrine. The state, as trustee of a public trust, protects public uses in the foreshore. The public trust concept in its traditional molding was inadequate to protect the public interest. In 1971 the California Supreme Court recognized the public's right to preserve the foreshore. The history of the tidelands trust doctrine is examined to discover whether the doctrine is flexible enough to meet the current requirements of the public interest in tidelands. The state has limitations on the choice of tideland allocation, either absolute or conditional. State ownership is necessary when the general welfare requires public use of the foreshore. There is a recognized need for a redefinition of the requirements of general welfare. The uses within California's tidelands can be modified, and implementation of environmentally-based public uses would best protect the public interest. (Daniels-Florida)
W80-05069

PUBLIC PARTICIPATION IN LOCAL LAND-USE PLANNING: CONCEPTS, MECHANISMS, STATE GUIDELINES AND THE COASTAL AREA MANAGEMENT ACT,
D. W. Ownes.
The North Carolina Law Review, Vol 53, No 5, p 975-1004, June 1975.

Descriptors: *North Carolina, *Land use, *Planning, *Public rights, Programs, Decision-making, State governments, Adoption of practices, Local governments, Legislation, Standards, Coasts, *Coastal Area Management Act.

The nature, extent and methodology of citizen participation in governmental planning and decision-making are important issues. Public participation should be given careful consideration in land use planning. North Carolina's 1974 Coastal Area Management Act (CAMA) contains provisions relating to public participation. However, the legislature made only perfunctury obeisance to the concept of public participation. The CAMA provisions and administrative proposals of the Coastal Resources Commission relating to public participation are discussed. The basic theories, definitions and issues involved in the concept of public participation are examined. There are at least three basic theories of citizen participation. Related to the choice of a theoretical basis for public participation is its meaning. Four basic definitional groupings are considered: citizen involvement, citizen influence, citizen power and citizen-government exchange. The mechanics and timing of public participation are discussed. Tools for public participation include: one-way output, one-way input, and interaction mechanisms. The requirements for public participation mandated by the CAMA are quite limited. Several recommendations to increase effective public participation are made. (Daniels-Florida)
W80-05070

THE EXTENT OF STATE OWNERSHIP OF SUBMERGED LANDS IN CALIFORNIA,
W. Arnone.
Hastings Law Journal, Vol 31, No 1, p 329-345, September 1979.

Descriptors: *California, *Boundaries(Property), *Ownership of beds, Judicial decisions, Boundary disputes, Legal aspects, Submerged lands act, Riparian rights, Public rights, Legislation, Navigable waters.

During 1970, the California Attorney General in conjunction with the California State Lands Commission initiated action to overturn 100 years of case and statutory law governing title to submerged lands in California. Statutory construction was generally that the state's ownership of these lands extended only to the low-water mark. The Attorney General asserted that state ownership of the lands beneath California non-tidal navigable waters extended to the high-water mark. This change in position has created uncertainty and confusion among the landholders potentially affected. The result has been a number of civil actions filed by landowners seeking judicial clarification of the extent of their landholdings. Until this issue is resolved conclusively, the property rights of all littoral and riparian landowners in California will remain in doubt. Several cases are now being heard at the appellate level. Both historically and legally the foundation for the state's claim is lacking. Therefore, judicial removal of this artificially created could upon title is imperative. (Wilson-Florida)
W80-05071

POLLUTION: INTERNATIONAL CONVENTIONS, FEDERAL AND STATE LEGISLATION,
J. J. Higgins.
Tulane Law Review, Vol 53, No 4, p 1328-1363, June 1979.

Descriptors: *Oil pollution, *Federal-state water rights conflicts, *International commissions, Oceans, International law, Oil spills, United Nations, Federal Water Pollution Control Act, State governments, Legislation, Ships.

The genesis of modern laws dealing with pollution of the oceans and littoral territories began in 1967 with the Torrey Canyon disaster. On the international level, oil pollution damage is covered by the Civil Liability Convention of the International Legal Conference, an agency of the United Nations. The Convention applies to ships carrying more than 2,000 tons of oil in bulk as cargo. The Convention covers oil pollution damage to the territory of a Contracting State. The Civil Liability Convention is supplemented by the Fund Convention. In the United States a party who suffers oil pollution damage may bring an action under common law and general principles of maritime law. The primary federal statute is the 1972 Federal Water Pollution Control Act (Act). The Act includes prohibitions against harmful discharges, requirements of evidence of financial responsibility, and provisions for penalties. Liability for oil pollution under state law depends on whether states are free to impose liability for such pollution. Questions have arisen whether state ocean pollution liability legislation unconstitutionally intrudes into an area of exclusive federal maritime jurisdiction or imposes a burden on interstate or foreign commerce. (Wilson-Florida)
W80-05072

FEDERAL WATER POLLUTION CONTROL ACT - THE FEDERAL GOVERNMENT'S EXCLUSIVE REMEDY FOR RECOUPMENT OF OIL SPILL CLEANUP COSTS,
R. T. Lemon, II.
Tulane Law Review, Vol 53, No 4, p 1421-1438, June 1979.

Descriptors: *Federal Water Pollution Control Act, *Oil spills, *Remedies, Oil pollution, Cleaning, Legislation, Judicial decisions, Environmental effects, Water pollution sources, Federal government.

The Federal Water Pollution Control Act (Act) was created to provide a national policy for the prevention, control and abatement of water pollution. One of the most serious threats to the waters of the United States is damage from oil spills. In addition to environmental damage, another effect of oil spills is the cleanup cost. The Act has provided a comprehensive plan designed to expedite oil pollution cleanup, and to establish a workable scheme for limiting liability for oil spill cleanup costs. Although other statutory and nonstatutory remedies exist concurrently with the Act, the federal government's exclusive remedy for reimbursement of cleanup costs is set forth in and limited by the Act. Although the Act does not state that it is the exclusive remedy, an examination of the Act's legislative history, of the statute's provisions and legislative character, and of the relevant case law indicate that the Act is the federal government's exclusive basis for recovery. (Wilson-Florida)
W80-05073

THE INTERNATIONAL REGIME FOR THE DEEP SEABED: PAST CONFLICTS AND PROPOSALS FOR PROGRESS,
Vanderbilt Univ., Nashville, TN. School of Law.
J. I. Charney.
Harvard International Law Journal, Vol 17, No 1, p 1-50, Winter 1976.

Descriptors: *Beds under water, *International commissions, *Law of the Sea, *Treaties, United Nations, International law, Conferences, International waters, Political aspects, Resources, Jurisdiction.

For the first time, virtually all nations of the world are seeking to establish an international organization to manage deep seabed resources. Nearly 150 nations participated in the second session of the Third United Nations Conference on the Law of the Sea. The principle product of that session was the Informal Single Negotiating Text (ISNT), which will form the basis for negotiations at the third session of the Law of the Sea Conference. Probably the most controversial part of the ISNT is that produced by the committee assigned to establish a regime for the management of seabed resources beyond the limits of national jurisdiction. Several compromise regimes have been suggested: (1) a phased regime; (2) a Tribunal with authority over the Seabed Authority; (3) open access for exploitation; and (4) modification of voting. All nations must give serious thought to the inadequacies present in the current First Committee texts and the available compromise solutions. (Wilson-Florida)
W80-05074

LAND USE CONTROLS IN COASTAL AREAS,
Kentucky Univ., Lexington
R. C. Ausness.
California Western Law Review, Vol 9, No 3, p 391-428, Spring 1973.

Descriptors: *Coastal marshes, *Coastal plains, *Land use, *Shore protection, Coasts, Environmental control, Legislation, Management, Water policy, Water pollution effects, Project planning.

Prolonged exploitation of coastal resources has caused extensive ecological harm. The coastal environment is acutely sensitive to human activities, like dredging, mining, and pollutant discharges. Estuarine areas have been particularly susceptible to harm from land development. Beach erosion is another adverse effect. A solution must include a wide range of regulatory devices, an administrative structure capable of effectively utilizing these enforcement tools, and a coherent public policy concerning the allocation of coastal zone resources. Any method of environmental control must take into account property rights in coastal areas. Congress enacted the Coastal Zone Management Act in 1972. This legislation seeks to encourage the development of comprehensive state management programs and the formulation of a national coastal zone policy. Governmental measures to protect the coastal environment are subject to a number of institutional and practical constraints, including commercial interests, inadequate state administrative resources, and due process requirement. Any effective implementation of a coastal zone management program must take into account these conflicting interests. (Wilson-Florida)
W80-05075

WILL THERE BE LAW AT SEA.
In: American Society of International Law: Proceedings of the Seventieth Annual Meeting, April 22-24, 1976, Washington, D.C., p 175-82, 1976. American Society of International Law, Washington, D.C.

Descriptors: *Law of the Sea, *International commissions, *International law, Negotiations, United Nations, Economics, Oceans, Foreign countries, Legal aspects, Jurisdiction.

The Law of the Sea negotiations raise a myriad of questions which deal with the deep seabed, 200-mile economic jurisdiction, the territorial sea and straits, scientific research, marine pollution, and dispute settlement. One question that will have to be resolved is which part of the deep seabed area will be open to exploitation. Furthermore, landbased producers fear that deep seabed mining would economically hurt them. The Informal Single Negotiating Text on the regime for straits used for international navigation was an attempt to find a compromise between those states that favored free transit and those that supported an innocent passage regime. In the exclusive economic zone, the central problem was how to harmonize other states' interests with those of the coastal state. The Single Negotiating Text imposed a general obligation on states to protect the marine environment. However, no real efforts have been made to deal with landbased pollution. A serious question remains as to the jurisdictional character of the 200-mile economic zone. The basic issue is whether an exclusive economic zone will take on the characteristics of a territorial sea. (Wilson-Florida)
W80-05076

INTERNATIONAL ENVIRONMENTAL PROTECTION: POLICY, LEGAL, AND TRADE ASPECTS.
In: American Society of International Law: Proceedings of the Seventy-First Annual Meeting, April 21-23, 1977, San Francisco, California, p 48-67, 1977. The American Society of International Law, Washington, D.C.

Descriptors: *International commissions, *Water pollution control, *Water pollution sources, *International law, Negotiations, Oceans, Water pollution, Environmental effects, Water law, Legal aspects, Water pollution effects.

The United Nations Conference on Human Environment in Stockholm in 1972 focused the attention of the international community on the issue of international environmental law. A principle achievement at Stockholm was the Declaration of Principles which set out principles of state responsibility for environmental damage. Since Stockholm, the attention has been mostly devoted to the ocean commons, including the effect of any new ocean regime on environmental aspects of ocean management. Other areas of concern include regulation of vessel source pollution, protection of living resources and transfrontier pollution problems. Transfrontier pollution includes disturbances that originate in one country, are transmitted through a shared natural resource, and effect another country or areas not under a specific national jurisdiction. A number of international bodies believe transfrontier pollution problems, to the extent possible, should be handled domestically. Countries should ensure foreign plaintiffs access to the same protection from environmental damage as is accorded their own inhabitants. National environmental measures with trade implications can take a number of forms either through regulations, taxes, or subsidies. (Wilson-Florida)
W80-05077

FLOOD CONTROL AND ARIZONA,
M. R. Rooney.
Law and the Social Order, Vol 1973, No 4, p 919-937, 1973.

Descriptors: *Arizona, *Flood control, *Flood plain zoning, *Flood protection, Legislation, Flood damage, Land use, Engineering projects, Project planning, Flood plains, Local governments, Zoning.

Despite its reputation as a desert state, Arizona has experienced severe, if infrequent flooding. In 1973, the Arizona legislature passed two bills designed to alleviate future flood damage. Flood control activities can be divided into two general areas: (1) corrective measures, or manmade engineering projects, designed to retain and control flood waters; and (2) preventive measures which regulate land use in areas susceptible to flooding. In passing the flood control assistance law, a corrective measure, the Arizona legislature for the first time made state funds available for a portion of the local share of a federally assisted flood control project. This law appropriates up to one-half of a community's share of project costs. On the other hand, the new preventive law attempts to regulate the development of the state's flood plains. Flood plain regulations are established to reduce the need for corrective projects. The strengths and weaknesses of both new flood control laws as applied in Arizona are analyzed. Possible modifications are recommended. (Schwerer-Florida)
W80-05078

FEDERAL JURISDICTION AND FEDERAL COMMON LAW - ENVIRONMENTAL LAW - PUBLIC NUISANCE SUITS CONCERNING IN-

TERSTATE WATER POLLUTION-ILLINOIS V. CITY OF MILWAUKEE, 406, U.S. 91 (1972),
R. A. Sherman.
Denver Law Journal, Vol 49, No 4, p 609-618, 1973.

Descriptors: *Judicial decisions, *Federal jurisdiction, *Water pollution control, *Illinois, Jurisdiction, Water pollution, State governments, Legal aspects, Sewage, Interstate, Waste disposal, *Wisconsin.

In the early 1970's the State of Illinois filed a motion for leave to file a bill of complaint under the original jurisdiction of the Supreme Court against four cities in Wisconsin and the Sewerage Commission of Milwaukee. Illinois requested that the Court abate the public nuisance being caused by the defendent's daily discharge of over 200,000,000 gallons of raw or inadequately treated sewage into Lake Michigan. The Court denied the motion and sent the case back to the appropriate federal district court for resolution of the controvery. The Court further reasoned that since the issue of a state-created public nuisance affecting another state is a federal question and that, in the absence of a specific substantive statutory remedy, the federal question should be resolved by applying the federal common law of nuisance. The significance of the decision lies in the Court's jurisdictional mandate and in its acknowledgement of the validity of federal common law in the adjudication of an interstate water pollution issue. (Wilson-Florida)
W80-05079

THE APPLICABILITY OF THE FEDERAL POLLUTION ACTS TO INDIAN RESERVATIONS: A CASE FOR TRIBAL SELF-GOVERNMENT,
L. E. Petros.
University of Colorado Law Review, Vol 48, No 1, p 63-93, Fall 1976.

Descriptors: *Indian reservations, *Clean Air Act, *Federal Water Pollution Control Act, Jurisdiction, Political aspects, Pollution abatement, Regulation, State jurisdiction, Federal jurisdiction, Water law.

The rapid development of Indian reservations raises the issue of how these lands are to be protected from pollution. Examined are the jurisdictional aspects of the Federal Water Pollution Control Act (FWPCA) and the Clean Air Act as applied to Indian reservation lands. Both acts are unclear as to whether Congress delegated power to the states to control pollution on reservation lands within their jurisdiction, or whether control was retained in the federal Environmental Protection Agency, the Interior Department of the Indian Tribes themselves. Of the two Acts, only the definitional section of the 1972 FWPCA even mentions Indians. Placing jurisdiction over Indian reservations in the states, absent an express congressional grant, violates basic principles of Indian law. Further analyzed is the question of whether self-regulation by the tribes exists within these two Acts. (Schwerer-Florida)
W80-05080

THE THIRD UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA: THE 1975 GENEVA SESSION,
J. R. Stevenson, and B. H. Oxman.
American Journal of International Law, Vol 69, No 4, p 763-797, October 1975.

Descriptors: *United Nations, *International law, *Law of the Sea, International waters, Treaties, Regulation, Governments, Boundary disputes, Political aspects, Legal aspects.

The principle procedural result of the Third United Nations Conference on the Law of the Sea (Conference) was the preparation of informal single texts covering all substantive subjects before the Conference. These texts are intended as a basis for negotiations of a comprehensive treaty. The texts are examined to explain the accomplishments of and the problems facing this Conference. The content of each text is compared with previous proposals and provisions. The texts of the following substantive subjects are examined: (1) the Territorial Sea and Contiguous Zone; (2) Straits Used for International Navigation; (3) The Economic Zone; (4) the Definition of Continental Shelf; (5) the High Seas; (6) Access to the Sea by Landlocked States; and (7) Archipelages. The conference also sought to compile standards on protection the marine environment. The overall effort of the conference is evaluated, successful completion of the conference was not met. (Daniels-Florida)
W80-05081

REGIONAL ARRANGEMENTS IN THE OCEANS,
Rhode Island Univ., Kingston.
L. M. Alexander.
American Journal of International Law, Vol 71, No 1, p 84-109, January 1977.

Descriptors: *Regional analysis, *Law of the Sea, *International waters, *Geographical regions, Regions, Institutions, Oceans, International law, Management, Treaties, Governmental interrelations.

Ocean management has changed since the first Law of the Sea Conference. Multistate regional interests and arrangements are emerging. Three types of marina regions are identified: (1) physical regions, basically ocean basins and semi-enclosed seas; (2) management regions, functional in nature and respond to management problem-solving; and (3) operational regions, sites of one or more regional arrangements. It is better to approach regional action from the perspective of environmental problems requiring action, than from the perspective of participating states, as concerns of each state may differ. Five necessary components of marine regional arrangements are discussed in detail: (1) the area of activity; (2) the institutional level; (3) the use category; (4) the objectives; and (5) the integrative forces. The scope of existing institutions is also presented to emphasize variations in nature and functions. Future developments hinge to a degree on the formulation of a treaty by the Conference. Regional arrangements will probably interact closely with certain geographic areas of the ocean, and international power relationships will no doubt be affected. (Tabano-Florida)
W80-05083

POLITICAL COBWEBS BENEATH THE SEA, Committee on Interior and Insular Affairs (U. S. Senate).
D. P. Stang.
International Lawyer (A.B.A.), Vol 7, No 1, p 1-15, January, 1973.

Descriptors: *United Nations, *Law of the Sea, *Treaties, *Resources development, Conferences, Jurisdiction, Governments, International law, International waters, Water resources, *Beds under water, *United Nations Seabed Committee.

The accomplishments of the United Nations Seabed Committee are examined during a two year period ending the summer of 1972. The Seabed Commission was the preparatory body for a 1973 Law of the Sea Conference. Two documents were agreed upon at the summer 1972 session, the only tangible results of two years work. The first document is a list of 107 issues and sub-issues which the 1973 Law of the Sea Conference should discuss. The second document contains draft texts on seabed principles. It is contended the Seabed Committee did not reach agreement on the major issues. There is a summary of the major unresolved issues reflected in these documents. The inherently political nature of the Seabed Committee may be a reason for its inability to reach agreement on major issues. The potential benefits of a moratorium on states' activities in the seabed area beyond their national jurisdiction is examined. (Daniels-Florida)
W80-05085

MARINE RESOURCES COMMITTEE (ANNUAL REVIEW OF ACTIVITIES - 1975). American Bar Association, Washington, DC. Natural Resources Section.
Natural Resources Lawyer, Vol 9, No 2, p 238-252, 1976.

Descriptors: *Marine fisheries, *Resources development, *Water pollution control, Beds under water, Administrative agencies, Water law, Coast guard regulations, Federal government, Judicial decisions, Legislation, Administrative decisions, *Outer Continental Shelf Lands Act.

As to United States (U.S.) offshore seabed resources, bills are pending in Congress that would extensively amend the Outer Continental Shelf Lands Act. In March, 1975, the United States Supreme Court decided the U.S. has sovereign rights over the seabed and subsoil underlying the Atlantic Ocean three miles from the coast. Coast Guard regulations for licensing, designing, constructing and operating deepwater ports were published in November, 1975. In 1975, the first preliminary approval of a state coastal zone management program occurred, when Washington's program was approved. Public Law 94-70 was enacted in 1975 to give effect to the International Convention for the Conservation of Atlantic Tunas. A proposed Convention on Civil Liability for Oil Pollution Damage from Offshore Operations was in the late stages of negotiation at the close of the year. The first criminal action under Section 311 of the Federal Water Pollution Control Act was initiated in Philadelphia against the captain of a Liberian tanker. (Wilson-Florida)
W80-05086

POSSIBLE SOLUTIONS TO THE 200-MILE TERRITORIAL LIMIT,
R. O. Freeman.
International Lawyer (A.B.A.), Vol 7, No 2, p 387-395, April 1973.

Descriptors: *Law of the Sea, *Resource allocation, *Boundary disputes, *Resources development, Resources, International law, International waters, Competition, Beds under water, Oceans, Conferences, United Nations.

Bilateral or multilateral agreements concerning the allocation of ocean resources are suggested as substitutes for unilateral declarations which attempt to control the exploitation of those resources. Controversy exists over the unilateral control of ocean resources beyond a nation's territorial limits. There is an analysis of the 200-mile limit, that zone extending up to 200 miles from a nation's coast, which some nations claim sovereignty over. The interests of the coastal antions are examined. Rather than having coastal nations decide the extent to which they may assert control over the contiguous sea, four alternative methods for deciding the extent of this control are given. International conventions regarding the exploitation of resources on a worldwide basis is considered the preferrable approach. A Cuban-Mexican draft proposal for an international convention, submitted at the Rome Conference of 1955, is briefly examined. The benefits of a convention and problems facing a convention's success are discussed. (Daniels-Florida)
W80-05087

INCLUDING GEOTHERMAL RESOURCES WITHIN THE MINERAL ESTATE: THE NEED FOR A STATUTORY RULE OF PRESUMPTION,
S. M. Farnsworth.
Brigham Young University Law Review, Vol 1978, No 3, p 593-616, 1978.

Descriptors: *Geothermal studies, *Energy conversion, *Resources development, Water policy, Water law, Judicial decisions, Energy, Legislation, Mineral industry, Natural resources.

Deciding whether a recently-found valuable resource is included within a general conveyance of all the mineral rights in a piece of property is not new to the courts. Near the turn of the century courts were asked to decide whether oil and gas were 'minerals' within the terms of deeds and leases. The difficulty in these cases arises because the term 'mineral' is used in so many senses. One

resource that has recently become valuable is geothermal energy. This increased interest in geothermal resources has raised the issue whether they belong to the mineral owner or to the surface owner. In determining these issues, courts can take different approaches: (1) constructional approach - examining the language used in the specific conveyance; or (2) functional approach - attempting to discern the intent of the parties by resorting to their general expectations regarding the use of their respective estates. While these approaches are effective, a preferable alternative would be a legislative determination of whether geothermal resources are presumptively included within the surface or the mineral estate. (Wilson-Florida)
W80-05088

ISLANDS AND THE DELIMITATION OF THE CONTINENTAL SHELF: A FRAMEWORK FOR ANALYSIS,
D. E. Karl.
American Journal of International Law, Vol 71, No 4, p 642-673, October 1977.

Descriptors: *Law of the Sea, *Continental Shelf, *Islands, International law, Boundaries(Surfaces), International commissions, Conferences, Foreign countries, Legal aspects, Analysis, United Nations.

One of the recurring problems in the law of the sea is the treatment of islands in the delimitation of the continental shelf between opposite and adjacent states. This issue has been magnified by developments at the Third United Nations Conference on the Law of the Sea, and in particular, by the adoption of equitable principles as the standard for delimitation of the continental shelf and exclusive economic zone between adjacent and opposite states. On the assumption that the content of these equitable principles may be derived from contemporary state practice in maritime delimitations, state practice is used to construct an analytical model of the continental shelf problem of islands. This model relies primarily on an island's relative location and secondarily on its relative size with respect to the delimiting states. It provides a framework for determining how an island should be treated in a given delimitation. The principles derived from this analysis will have an important bearing on the new problem of the delimitation of the exclusive economic zone. (Wilson-Florida)
W80-05089

WATER DELIVERIES UNDER THE RIO GRANDE COMPACT,
S. E. Reynolds, and P. B. Mutz.
Natural Resources Journal, Vol 14, No 2, p 201-205, April 1974.

Descriptors: *New Mexico, *Colorado, *Water allocation(Policy), Water control, Water resources, Water supply development, Water rates, Consumptive use, Water storage, Projects, *Rio Grande Compact.

This is a record of the water deliveries to and releases from project storage by Colorado and New Mexico under the Rio Grande Compact (Compact). Both Colorado and New Mexico have been in a debit status during most of the time the Compact has been in effect. Debit status means withdrawing more water than one has delivered to the project reservoirs. The practical effect of debit status has been to restrict the use of reservoirs constructed after 1937 in Colorado above Lobatos and after 1929 in New Mexico above San Marcial. The reasons for the debit status of these states and for reversing of this status are explored. As a result of New Mexico's and Colorado's debit status, Congress authorized a cooperative effort to rectify the Rio Grande channel and other works. Colorado has also been sued to enforce the Compact. By 1972 New Mexico liquidated her debit and Colorado established a definite trend toward credit status. (Daniels-Florida)
W80-05090

WRESTLING WITH WATER QUANTIFICATION IN WESTERN STATES,
G. Othmer.
Natural Resources Journal, Vol 14, No 3, p 423-430, July 1974.

Descriptors: *Water measurement, *Reservation doctrine, *Federal-state water rights conflicts, Water distribution(Applied), Water allocation(Policy), Federal government, Water policy, Water resource development, Water permits, Water utilization.

Nineteen states have adopted various types of state administered water distribution systems, attempting to achieve maximum efficiency in water usage. The practicalities of administration are complicated. The state water administrative bodies are plagued by one very unpredictable water user -- the United States Government. This obstacle to effective quantification by state government is an outgrowth of two decisions that have since been modified. These decisions stated that, whenever Congress sets land aside for a particular purpose, an unspecified quantity of water is reserved. The Federal Government hesitates to document the types of uses and the quantities of water it will use on federal land under state programs. The difficulty of the federal position is illustrated by comparing individual state reactions to classifying recreational or conservational uses as beneficial uses. Whether or not federal uses would be considered beneficial would be subject to nineteen interpretations. This uncertainty forces federal agencies into state proceedings which might inhibit planning and destroy valuable water rights. Some system of uniform reporting should be established to aid western states in water-use planning. A sample uniform federal form is suggested. (Daniels-Florida)
W80-05091

THE RAINBOW BRIDGE CASE AND RECLAMATION PROJECTS IN RESERVED AREAS,
J. B. Draper.
Natural Resources Journal, Vol 14, No 3, p 431-445, July 1974.

Descriptors: *Federal Project policy, *Reclamation, *Project planning, Federal government, Legislation, Projects, Water resources development, Environmental effects, Legal aspects, National parks, National monuments.

The following theory is tested: that an invasion of a reserved area, such as a national monument, by a reclamation project will be permitted by Congress when two or more projects threatening to invade different reserved areas are proposed to Congress simultaneously. In the Rainbow Bridge case, the court did not enjoin a reclamation project which resulted in an invasion of a national monument. The Rainbow Bridge decision and its impact as a political precedent are analyzed in order to test this theory against several other reclamations controversies involving reserved areas held by the federal government. There are only two multiple-project controversies against which the theory can be tested. The first involved the 1956 Colorado River Storage Act which resulted in the flooding of Rainbow Bridge. The second was the 1968 Colorado River Basin Project Act which authorized a reservoir in the Gila Wilderness. The theory advanced is valid, but some modifications should be made. Only when normal alternatives open to Congress are limited, and two or more projects are proposed simultaneously will an invasion of reserved areas be permitted. (Daniels-Florida)
W80-05092

SALINITY ASPECTS OF THE COLORADO RIVER AGREEMENT,
Texas Tech Univ., Lubbock.
H. E. Dregne.
Natural Resources Journal, Vol 15, No 1, p 43-53, January 1975.

Descriptors: *Colorado River Basin, *Water quality control, *Salinity, *Mexico, Colorado River, Treaties, Agriculture, Governmental interrelations, Financial feasibility, River basins, Water users, Water delivery.

The 1973 Colorado River agreement between Mexico and the United States is intended to resolve the conflict over the salinity of the river at the international boundary. Prior to this agreement, the United States had been pumping water of a high saline quality into Mexico as part of its allotment under treaty. Mexican agricultural interests protested, and the United States agreed to pump water of a satisfactory quality to Mexico and to maintain that quality. Although the dispute has been settled, the salinity problem in the river remains. Dam reservoirs and irrigation are major causes of the salinity problem, and future water development programs could lead to further degradation. Salinity control measures are now being undertaken to keep the content at acceptable levels. Problems with the agreement exist, including cost and the fact that the basin states were not made a part of the decision-making process. Modern technology can keep the salinity at acceptable levels, but success will not be easily achieved. (Tabano-Florida)
W80-05093

PORT AUTHORITIES VIEW STATE COASTAL MANAGEMENT PROGRAMS,
Maine Dept. of Transportation, Portland. Bureau of Waterways.
E. Langlois.
Coastal Zone Management Journal, Vol 2, No 2, p 171-176, 1975. 2 Fig.

Descriptors: *Port authorities, *Shore protection, *Economic impact, Planning, Development, Programs, Environmental engineering, Surveys, Harbors, Management, Coasts.

The American Association of Port Authorities conducted a survey among its member ports, to determine the extent of their interest and participation in the planning and implementation of their state coastal zone management programs. According to most port directors surveyed, a coastal zone management plan should provide the vehicle to balance economic development and environmental concerns. Introducing new and expensive facilities into existing ports requires extensive waterfront property acreage. Permits must be obtained for dredging in waterways and disposing of spoils. Environmental impact statements must be prepared. This concern for the environment is growing along with the development of new legislation, policy, guidelines, and regulations at all levels of government. The federal Coastal Zone Management Act (Act) has added a new dimension to the thinking of the port authority director. Port directors wonder how the need for ports and commerce fits into coastal planning programs. Twenty-three ports have assigned personnel to work with state planners in implementing the Act. Thirty ports have growth plans ready for implementation or on the drawing boards. (Wilson-Florida)
W80-05094

SOME LEGAL ISSUES IN THE COASTAL ZONE MANAGEMENT ACT: GRANT-IN-AID ASPECTS - PART ONE,
Wisconsin Univ. Madison.
Z. L. Zile.
Coastal Zone Management Journal, Vol 3, No 1, p 30-70, 1976.

Descriptors: *Grants, *Coasts, *Shore protection, *Federal-state water rights conflicts, Federal government, Legislation, Administrative agencies, Legal aspects, Regulations, Administration, Management, State governments.

There are potentially troublesome legal issues deriving from the nature of the Coastal Zone Management Act (Act) as a grant-in-aid measure. The tension between federal and state perceptions of the coastal realities are explored. This tension may result in nonutilization of underutilization of the Act. Several agency strategies are hypothesized and evaluated as a means for bridging the gap. Questions associated with grant awards, program approval and termination of assistance are surveyed. Occasional conflicts between the granting agency and the recipient may reach litigation stage, especially due to the intervention of politically active third parties. The legal nature of grants procedural guarantees, judicial review and stand-

ing requirements of third parties are analyzed. Principles of general administrative law are applied to specific situations envisioned by the Act and its implementing regulations. Conclusions and recommendations are made in the second part of this article. (Daniels-Florida)
W80-05095

SOME LEGAL ISSUES IN THE COASTAL ZONE MANAGEMENT ACT: GRANT-IN-AID ASPECTS - PART TWO,
Wisconsin Univ.-Madison.
Z. L. Zile.
Coastal Zone Management Journal, Vol 3, No 2, p 151-169, 1977.

Descriptors: *Coasts, *Land use, *Shore protection, Administrative agencies, State governments, Federal government, Administration, Grants, Participating funds, Legal aspects, Management, Legislation.

Legal issues regarding compliance with grant conditions and participation in the development of coastal management programs are considered. Assistance under the Coastal Zone Management Act (Act) is in the form of conditional grants. The granting agency is obligated, in principle, to secure compliance with the grant conditions. Most administrative review of grantee performance occurs in the day-to-day work process. The presence of Congressional review is an incentive. The Act, the implementing regulations and the grant instruments provide mechanisms to cope with most contingencies. Lax enforcement of grant conditions can invite third-party intervention, robbing the granting agency of some of its initiative and control over the dispute settlement process. Participation in coastal management programs is developed in numerous legal guarantees, invitations and procedures. Some uncertainty remains as to whether the words can be translated into action approximating what was intended. The loose standards for participation might be used by parties pursuing diverse objectives to impede coastal zone management. (Daniels-Florida)
W80-05096

STATE REVIEW OF LOCAL LAND-USE DECISIONS: THE CALIFORNIA COASTAL COMMISSIONS,
California Univ., Davis.
P. Sabatier.
Coastal Zone Management Journal, Vol 3, No 3, p 255-290, 1977. 8 Tab.

Descriptors: *California, *Land use, *Shore protection, Permits, Legal aspects, Decision making, Reviews, Coasts, Land development, Local governments, Legislation.

The California Coastal Zone Conservation Commissions have been required to review virtually all development projects approved by local government within approximately 1000 yards of the coast. Ninety-seven percent of all permits were approved in some fashion by the regional commissions. Examined are the 4% of regional commission decisions that were significant or controversial enough to be appealed to the State Commission in the first 2 1/2 years of the permit review program. The regional commissions imposed conditions on or denied more than 50% of the projects subsequently appealed to the State Commission. The State Commission held even more restrictive views of permissable development. There are a number of reasons for the more restrictive state view, including differences in policy, the presence of state-appointed commissioners, and the willingness of environmental groups to become actively involved in the appellate process. All are necessary conditions for obtaining comparably stringent policy outputs. (Daniels-Florida)
W80-05097

FLORIDA AND COASTAL ZONE MANAGEMENT,
J. R. Brindell.
The Florida Bar Journal, Vol 54, No 4, p 295-299, April 1980.

Descriptors: *Florida, *Coasts, *Shore protection, Federal government, State government, Legislation, Management, Resources development, Resources, Programs.

Florida has an interrelationship between land and coastal waters more extensive than that of any other state. The magnetism of these natural features has created Florida's most fundamental dilemma -- how to maintain the benefits of our coastal resource and maximize individual freedom of choice, without destroying the benefits. On a national level, the 1972 Coastal Zone Management Act (CZMA) was enacted to deal with this dilemma. CZMA calls for non-compulsory state participation in the federal management program. The Florida legislature passed the 1978 Florida Coastal Management Act (FCMA) directing a state program, based upon existing state laws and regulations, be submitted to the federal government for approval. The focus of the state program is a refinement of current management and regulatory schemes so that Florida's coastal resources will be effectively managed. The current effort provides a timely and useful framework within which Florida can significantly improve resource management. (Daniels-Florida)
W80-05100

6F. Nonstructural Alternatives

WATER LEGISLATION PERSPECTIVES FOR ALABAMA,
Alabama Univ., University.
For primary bibliographic entry see Field 6E.
W80-04934

MANAGING RECREATIONAL RIVERS,
National Association of Attorneys General, Raleigh, NC.
For primary bibliographic entry see Field 6E.
W80-04935

PROTECTING AQUIFERS FOR THE FUTURE.
Ground Water Age, Vol 14, No 6, p 26-27, 30, 32, February, 1980.

Descriptors: *Municipal water, *Water pollution control, *Aquifers, *Planning, Buried valley aquifer, Massachusetts, Water zoning, Land use, Local governments, Non-structural alternatives, Suburban areas, Surveys, Mapping, *Aquifer management.

Stow, Massachusetts, which depends on private wells for its water supply, hired an environmental planning firm to map major aquifers and recharge areas and make recommendations to protect and preserve its ground water. This resulted in the formation of an aquifer protection district, adoption of new zoning laws, changes in current zoning practices relating to septic systems and housing density, and identification of proper areas for industrial and commercial development, road salting and possible future municipal well fields. (Purdin-NWWA)
W80-04948

FLOOD CONTROL AND ARIZONA,
For primary bibliographic entry see Field 6E.
W80-05078

6G. Ecologic Impact Of Water Development

FORESTS AND FLOODING WITH SPECIAL REFERENCE TO THE WHITE RIVER AND OUACHITA RIVER BASINS, ARKANSAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2I.
W80-04854

SIMULATION OF WETLANDS FOREST VEGETATION DYNAMICS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2I.
W80-04860

ESTUARINE SANCTUARIES - THE OREGON EXPERIENCE,
For primary bibliographic entry see Field 6E.
W80-04922

SAVING CALIFORNIA'S COAST: THE COASTAL ZONE INITIATIVE AND ITS AFTERMATH,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-04924

AN ANALYSIS OF THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978,
Nossaman, Waters, Krueger, Marsh and Riordan, Los Angeles, CA.
For primary bibliographic entry see Field 6E.
W80-04962

OBSTACLES TO GEOTHERMAL DEVELOPMENT,
For primary bibliographic entry see Field 5C.
W80-04983

THE PRESSURE FOR SHORELINE DEVELOPMENT: SPATIAL CONCEPTS IN REVIEW,
Ottawa Univ. (Ontario).
For primary bibliographic entry see Field 6E.
W80-04991

STATE AND LOCAL WETLANDS REGULATION IN THE COURTS: CONSTITUTIONAL PROBLEMS ON THE WANE,
For primary bibliographic entry see Field 6E.
W80-04997

FEDERAL CONTROL OF WETLANDS: THE EFFECTIVENESS OF CORPS' REGULATIONS UNDER SECTION 404 OF THE FWPCA,
For primary bibliographic entry see Field 6E.
W80-05005

A PRELIMINARY FEASIBILITY STUDY TO IRRIGATE WESTERN UMATILLA AND NORTHEASTERN MORROW COUNTIES, OREGON.
Oregon Dept. of Water Resources, Salem.
September 1975, 30 p, 12 Maps.

Descriptors: *Irrigation, *Columbia River, *Feasibility studies, Oregon, Irrigation districts, Reservoirs, History, Dams, Canals, Wells, *Umatilla Co.(OR), *Morrow Co.(OR).

Twelve alternative plans are presented for irrigation of west Umatilla and northeast Morrow Counties (OR), using water pumped from the Columbia River. Each plan is divided geographically, with initial and annual costs for each segment given separately. At present, about 20,000 acres in the area are irrigated from wells; withdrawal of ground water is greater than recharge. The Stanfield and Westland Irrigation districts currently obtain their water supply from spring runoff in the Umatilla River with storage at McKay Reservoir. A rate of nine gal/min/acre was used in the study as a peak irrigation requirement, except for plans 10 and 12. The 12 alternatives are: (1) irrigation water provided to the entire 79,700-acre area from a point on the river below Umatilla, using pipelines and canals to irrigate higher elevations; (2) same as no. (1) except only pipelines used for higher elevations; (3) 65,340 acres west of Umatilla River from below Umatilla; (4) 75,262 acres; Butter Creek area excluded; (5) 50,905 acres; higher areas excluded; (6) 15,000 acres currently irrigated plus 31,468 acres in Stanfield-Westland; (7) 6,510 acres currently irrigated plus 7,850 acres in Stanfield from a point below Hat Rock State Park; (8) same as no.

(7) excluding 6,510 acres; (9) 60,592 acres west of Umatilla River from below Umatilla; (10) same as no. (9) except seven gal/min/acre; (11) 79,700 acres from below Hat Rock Park; (12) same as no. (11) except five gal/min/acre. (Lynch-Wisconsin)
W80-05017

7. RESOURCES DATA

7A. Network Design

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1978 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
R. K. Knott.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $2.25, Microfiche $3.50. Geological Survey open-file report 79-1349, 1979. 17 p, 2 Tab.

Descriptors: *Discharge measurement, *Network design, *Water quality, *Monitoring, *Stations, Arkansas, Streams, Data collections, Streamflow, Flow rates, Stage-discharge relations, Gaging stations, *U.S. Geological Survey, *U.S. Army Corps of Engineers.

Discharge data were computed for a network of water-quality monitoring stations operated throughout Arkansas by the Arkansas Department of Pollution Control and Ecology. Each site is numbered and described. Some of the sites are located at U.S. Geological Survey or U.S. Army Corps of Engineers daily-discharge stations, but most are at points where discharges are not regularly measured. Data were obtained as follows: (1) For sites located at gaging stations, discharges were obtained from Geological Survey and Corps of Engineers annual publications; (2) for sites not too distant from gaging stations, discharges were estimated by using gaging-station records; and (3) for other sites, a series of discharge measurements were made at each site to define a stage-discharge curve from which discharge was computed. Discharges on days of sampling were determined for about 90 of the sites. A tabular summary for the water year 1978 is given. Several discharges for miscellaneous dates in the 1977 water year are shown. (Kosco-USGS)
W80-04851

EPA CONSOLIDATION OF PERMITS PROPOSAL-REGULATORY WORKHORSE OR BUREAUCRATIC NIGHTMARE,
Water Pollution Control Federation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05037

NEW NATIONWIDE HYDROLOGIC INVESTIGATIONS.
For primary bibliographic entry see Field 6A.
W80-05099

7B. Data Acquisition

ORGANIC SOLUTE-MINERAL SURFACE INTERACTIONS: A NEW METHOD FOR THE DETERMINATION OF GROUNDWATER VELOCITIES,
Indiana Univ. at Bloomington.
P. Ciccioli, W. T. Cooper,, P.M. Hammer, and J. M. Hayes.
Water Resources Research, Vol 16, No 1, p 217-223, February 1980. 5 Fig, 1 Tab, 16 Ref. ORNL (Sub. 7031) W-7405-ENG-26.

Descriptors: *Groundwater movement, *Tracers, *Organic compounds, *Velocity, Solutes, Surfaces, Polarity, Adsorption, Groundwater, Measurement, Mass transfer, Equipment, Halocarbons, Multiple tracer procedure.

When the adsorption processes affecting the migration rates of organic solutes in groundwater systems are considered in detail, it can be shown that the use of multiple tracers should allow accurate calculation of the groundwater velocity even when all the tracers are retarded to some extent by interactions with mineral surfaces in the aquifer and even when the extent of that retardation is not known beforehand. It should be required only that the tracers be members of a series of compounds whose surface interaction energies vary regularly, this condition being met, for example, by compounds in the series C2ClnF(6-n). Experimental studies aimed at testing this concept show that two series of tracers behave as expected on laboratory columns (limestone and sand), thus indicating the fundamental validity of the approach. Further, the nature of the interactions between the mineral surfaces and the tracer molecules can be shown in these cases, at least, to be nonspecific, the strength of the interaction depending only on the polarizability of the tracer molecule. It seems likely that other satisfactory tracers can be selected using this criterion and that the approach should be applicable even to systems involving many different mineral surface types. (Visocky-ISWS)
W80-04827

DEVELOPMENT OF A SELF-SEALING SAMPLER FOR EPHEMERAL WADI FLOODS,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
M. Levin, E. Adar, and A. Barzilai.
Water Resources Research, Vol 16, No 1, p 245-249, February 1980. 5 Fig, 1 Ref.

Descriptors: *Sampling, *Floods, *Deserts, *Intermittent streams, Equipment, Instrumentation, Design, Precipitation(Atmospheric), Rainfall, Flash floods, Hydrology, Flood samplers.

The sampling of random floods for the analysis of environmental isotopes in flood water is handicapped by the fact that this water may partially evaporate between the time of the flood and the actual collection of the sample. Conventional methods of sampling are frequently ineffective, as floods occur at random both in time and space. With these considerations in mind, an instrument that enables automatic sampling of flood water was designed and built. The sample is hermetically sealed, and secondary effects that could change the original sample in any way are thus avoided. (Sims-ISWS)
W80-04830

EXPERIMENTAL DETERMINATION OF THE VELOCITY GRADIENT IN TWO DIMENSIONAL TURBULENT FLOW,
Vanderbilt Univ., Nashville, TN.
For primary bibliographic entry see Field 8B.
W80-04836

A NEW MEASURING DEVICE FOR QUICKLY VARYING LIQUID LEVELS (PRINCIPE D'UN NOUVEAU DISPOSITIF DE MESURE DES NIVEAUX DE LIQUIDES),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
J. Piquemal, and J. J. Barrau.
Journal of Hydraulic Research, Vol 18, No 1, p 83-86, 1980. 4 Fig.

Descriptors: *Water levels, *Measurement, *Instrumentation, *Interfaces, Light, Cathodes, Laboratory equipment, Stratified flow, Reflectance, Optical properties, Free surfaces, Flow, Nonmiscible fluids.

A light point can be visualized upon the partition surface of two fluids. An optical system can follow the displacement of this point. The advantages of this system are: (1) the noncontacted probing that does not disturb the flow, (2) very high band pass, and (3) measurement can be realized when classical systems are unsuited (nonconductor fluids, stratified flow interface with nonmiscible fluids). (Humphreys-ISWS)
W80-04839

PYRANINE USED AS A FLUORESCENT TRACER IN HYDROLOGY: PH EFFECTS IN DETERMINATION OF ITS CONCENTRATION,
CEA Centre d'Etudes Nucleaires de Grenoble (France).
M. Launay, M. Tripier, J. Guizerix, M. L. Viriot, and J. C. Andre.
Journal of Hydrology, Vol 46, No 3/4, p 377-383, April 1980. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Tracers, *Fluorescent dye, *Laboratory tests, *Analytical techniques, Dyes, *Hydrogen ion concentration, Streamflow, River flow, On-site investigations, Dye releases, Hydrology, Fluorescence, *Pyranine, Excitation, Buffering.

Pyranine is used as a fluorescent tracer in hydrology; but this compound which may exist under several ionic forms has, for a given concentration, a fluorescence emission which depends strongly on the pH. A simple method was proposed for the measurement of fluorescence intensity of the tracer by buffering solutions at fixed pH values: pH 10 (excitation at 450 nm, emission at 515 nm) or pH 5 (excitation at 403 nm, emission at 515 nm). In both cases, the limit of detection is close to 4 x 10 to the minus 10th power g/g. (Sims-ISWS)
W80-04846

DETERMINATION OF TRACE ELEMENTS IN NATURAL WATERS BY THE D.C. ARGON PLASMA, MULTIELEMENT ATOMIC EMISSION SPECTROMETER (DCP-MAES) TECHNIQUE,
Colorado State Univ. Fort Collins. Dept. of Chemistry.
G. W. Johnson, H. E. Taylor, and R. K. Skogerboe.
Spectrochimica Acta, Vol 34B, p 197-212, 1979. 7 Fig, 10 Tab, 14 Ref.

Descriptors: *Trace elements, *Natural streams, *Surface waters, *Groundwater, *Evaluation, Analytical techniques, Spectrometers, Instrumentation, Chemical analysis, *Atomic emission spectrometry.

The capabilities and limitations of a commercial direct current argon plasma, multielement atomic emission spectrometric (DCP-MAES) technique for the determination of 18 common elements in water have been evaluated. The results demonstrate that the unit offers acceptable capabilities with respect to selectivity, sensitivity, accuracy, speed and economy for the determination of many of the elements investigated. Interferences in the determinations of those elements subject to stray light due to the presence of calcium and (or) magnesium can often be compensated for by use of a simple linear correction procedure. A comparison of two-electrode and three-electrode d.c. argon plasma systems has shown that the latter offers advantages such as improved stability and lower background. A comparison with results published for a system based on excitation in an inductively coupled plasma has indicated that the present system offers comparable analytical capabilities for several of the elements investigated. (Kosco-USGS)
W80-04858

THE USE OF THE CLIMATIC WATER BUDGET TO EVALUATE THE VALIDITY OF A PRECIPITATION RECORD,
Delaware Univ., Newark. Dept. of Geography.
J. R. Mather, and C. M. Rowe, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182157, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Technical Research Report, 1979. 25 p, 10 Fig, 4 Tab, 12 Ref, 3 Append. OWRT A-040-DEL(5), 14-34-0001-9008.

Descriptors: *Water balance, *Hydrologic budget, *Precipitation(Atmospheric), *Climatology, *Runoff, Industrial water, Inflow, Flow rates, Correlation analysis, Water management, Indiana, La Porte area(Ind).

From 1927 to 1963 the precipitation recorded at La Porte, Indiana about 30 miles southeast of the

Chicago-Gary industrial complex was significantly higher than the precipitation found at any nearby station. Two reasons have been suggested for this anomaly. The first assumes that the record is correct and suggests that industrial pollution has resulted in increased downwind precipitation amounts. The second assumes that the record is incorrect and is merely the result of instrumental or observer error. This report describes the use of the climatic water budget to determine the more likely conclusion. Values of runoff were computed from climatic data from La Porte as well as from South Bend, and Plymouth, Indiana, the stations nearest to La Porte. The computed runoff values from South Bend and Plymouth were most closely correlated with the anomalously high precipitation could have occurred in a cylinder only 1.37 miles in radius centered over La Porte, without significantly changing basin runoff. Such a small area of anomalously high precipitation would seem unlikely to occur as a result of industrial pollution. The water budget, thus, suggests that observer error is a more realistic suggestion than industrial pollution for the La Porte anomaly.
W80-04877

MICHIGAN JOB USES GEOPHYSICAL AIDS,
UOP, Inc., St. Paul, MN. Johnson Div.
W. L. Anderson.
Johnson Driller's Journal, Vol 51, No 6, p 2-4, 9, November-December, 1979. 3 Fig.

Descriptors: *Gravity studies, *Subsurface investigations, *Glacial aquifers, Michigan, Gravimeters, Digital computers, Bedrock, Valleys, Lake sediments, Ground water, Municipal water, Water supply, Remote sensing, Geophysics.

A gravity survey of a glacial drift area in and around Munising, Michigan used a La Coste and Romberg Model G gravimeter and a CDC digital computer to adjust data for effects of latitude, elevation, etc. Results of the survey indicated that an extensive buried valley existed beneath the city with an estimated overburden thickness of 200 feet. The presence of highly permeable lake sands throughout the area suggested that the valley fill might consist principally of permeable glacial deposits. Subsequent drilling and aquifer testing confirmed this hypothesis. (Purdin-NWWA)
W80-04943

PRECISION DRILLING FOR DAM SAFETY.
For primary bibliographic entry see Field 8A.
W80-05055

7C. Evaluation, Processing and Publication

INTERVENTION ANALYSIS WITH MISSING DATA,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier.
Water Resources Research, Vol 16, No 1, p 159-171, February 1980. 5 Fig, 6 Tab, 12 Ref, 1 Append. NRC AT(49-24)-022.

Descriptors: *Estimating equations, *Time series analysis, *Model studies, *Mathematical models, Data processing, Data collections, Meteorological data, Hydrologic data, Water quality, Water pollution, Environment, Statistics, Monte Carlo method, Analytical techniques, Missing data, Missing data estimation, Intervention analysis.

Intervention analysis is a potentially useful tool for modeling time series when the process mean undergoes changes as the result of an external perturbation. The utility of the technique for water resource applications is, however, limited by the requirement that the data be collected uniformly in time. Two approaches for estimating missing data, one of which provides minimum variance estimates when model parameters are known, and a computationally simpler approximation were investigated. The approximation was found to be quite adequate and was incorporated in a practical scheme to estimate missing data and model parameters simultaneously. Subsequently, a method for estimating the parameter variance for use in significance tests on the intervention magnitude was investigated. The adequacy of the approximation was assessed in a series of Monte Carlo tests using three models consisting of step, linear, and impulse decay trends in mean with residual lag 1 Markov noise. Results of the experiments indicated that the suggested method provides adequate estimates of the variance of the intervention magnitude of the step and impulse decay models but that the variance was substantially overestimated for the linear model. However, for the same proportion of missing data the accuracy of the approximation improved as the sample size increased. (Sims-ISWS)
W80-04823

TECHNIQUES FOR EXPLORING AND PRESENTING DATA APPLIED TO LAKE PHOSPHORUS CONCENTRATION,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 2, p 290-294, February 1980. 2 Fig, 3 Ref. NOAA 03-78-B01-109.

Descriptors: *Water quality, *Phosphorus, *Lakes, *Data processing, Statistics, Model studies, Analytical techniques, Data collections, Limnology, *Data presenting.

Water quality sampling and data analysis are undertaken to acquire and convey information. Therefore, when data are presented, the form of this presentation should be such that information transfer is high. For example, a graph or table of average values is often an inadequate summary of batches of data. As an alternative, a technique was presented (that was developed for exploratory data analysis purposes) that can be used to display several sets of data on a single graph, indicating median, spread, skew, size of data set, and statistical significance of the median. This technique is useful in the study of phosphorus concentration variability in lakes. Additions to, and modifications of, this procedure are easily made and will often enhance the analysis of a particular problem. Some suggestions were made for useful modifications of the plots in the study and display of phosphorus lake data and models. (Sims-ISWS)
W80-04843

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2A-1. SOUTH FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-142797, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-2A-1, November 1979. 293 p, 14 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, Gaging stations, Streamflow, Flow rates, Sediment transport, Lakes, Reservoirs, Data collections, Sites, *South Florida, Lake elevations.

Water resources data for the 1978 water year for South Florida includes discharge records for 78 streams, stage-only records for 65 streams, elevations for 19 lakes, miscellaneous measurements, and crest-stage partial records for 6 streams. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State, and Federal agencies in Florida. (Kosco-USGS)
W80-04847

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2A-2. SOUTH FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-142805, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-2A-2, November 1979. 711 p, 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Water quality, Gaging stations, Sediment transport, Water analysis, Water temperature, Chemical analysis, Data collections, Sites, *South Florida.

Water resources data for the 1978 water year for South Florida includes water quality data for approximately 290 surface water sites. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State, and Federal agencies in Florida. (Kosco-USGS)
W80-04848

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 2B. SOUTH FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-141914, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-2B, November 1979. 602 p, 18 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Groundwater, *Water quality, Water analysis, Water temperature, Chemical analysis, Water wells, Water levels, Data collections, Sites, *South Florida.

Water resources data for the 1978 water year for South Florida include water level measurement for 299 wells and water quality for 500 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State, and Federal agencies in Florida. (Kosco-USGS)
W80-04849

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 4. NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134364, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-4, October 1979. 731 p, 45 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northwest Florida.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Northwest Florida includes discharge records for 69 streams, elevations for 27 lakes, water-level measurements for 94 wells, crest-stage partial records for 25 streams, water-quality data for 50 streams and 110 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-04850

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, NYE COUNTY, NEVADA 1976-77,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-04853

WISCONSIN, A SUMMARY OF ACTIVITIES AND PLANS OF THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 1979.

Geological Survey, Madison, WI. Water Resources Div.
Geological Survey Wisconsin District report, 1979. 81 p.

Descriptors: *Wisconsin, *Projects, *Water resources, *Geological Survey, *Land resources, Mineralogy, Water resources development, Hydrologic data, Floods, Sediment transport, Streamflow, Low flow, Groundwater resources, Aquifer characteristics, Water quality, Mapping, Publications, Bibliographies, Reviews.

The U.S. Department of the Interior's Geological Survey, established in 1879, is the Nation's principal fact-finding agency concerned with physical resources--the configuration and character of land surface, the composition and structure of the underlying rocks, and the quality, extent, and distribution of water and minerals. The Survey is an impartial fact-finding and research agency that gathers and interprets data so that managers can make decisions based on objective information. The Wisconsin program of the U.S. Geological Survey is, for the most part, planned and funded with local and State agencies through cooperative programs. This booklet will be useful to cooperating agencies by providing an understanding of all current studies and identifying present and future resource problems that are relevant to the experience and competence of the Survey in Wisconsin. (Kosco-USGS)
W80-04859

KNIK GLACIER, ALASKA, MAY 1979 MONUMENT AND GLACIER SURVEY,
Geological Survey, Fairbanks, AK. Water Resources Div.
D. C. Trabant, and L. R. Mayo.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $6.50, Microfiche $4.50. Geological Survey open-file report 80-48, 1979. 20 p, 3 Fig, 2 Plates, 7 Tab, 4 Ref.

Descriptors: *Glaciers, *Alaska, *Surveys, *Lakes, *Dams, Ice, Dam failure, Floods, Forecasting, Measurement, Altitude, Maps, Analytical techniques, Data collections, *Knik Glacier(Alaska).

From 1915, or earlier, to 1966, with the exception of 1963, Knik Glacier annually formed and released Lake George, the largest glacier-dammed lake in Alaska. Eleven geodetically controlled survey stations were defined in the basin, and 22 glacier surface altitudes were measured. This is the first effort in a continuing program whose goal is predicting the future behavior of Knik Glacier and Lake George. (Kosco-USGS)
W80-04863

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING WELL DENSITY IN THE GROUND-WATER SUBUNITS AND AREAS,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
J. C. Faughn.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO 80225, Paper copy $4.75, Microfiche $0.50. Geological Survey open-file map 79-1298, 1979. 1 Sheet.

Descriptors: *Maps, *Water wells, *Water levels, *Aquifers, California, Antelope Valley-East Kern Water Agency area, *Groundwater subunits.

A map (scale, 1:125,000) shows ground-water subunits and areas and the density of wells in the Antelope Valley-East Kern Water Agency areas, California. (Kosco-USGS)
W80-04865

GROUND WATER FLOW COMPUTATIONS BY METHOD OF LINES,
Florida Univ., Gainesville. Hydrology Lab.
A. D. Koussis, and R. W. Watson.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No 1R1, p 1-8, March, 1980. 3 Fig, 10 Ref.

Descriptors: *Ground water movement, *Numerical analysis, *Method of Lines, Equations, Aquifers, Water table, Approximation method, Seepage.

Numerical integration by Methods of Lines is applied to general conditions of two-dimensional unconfined ground water flow. According to this method, the original partial differential equation (PDE) is converted to a set of coupled ordinary differential equations (ODE) by discretizing in one of the independent variables while keeping the other continuous. The set of ODE thus obtained can be solved by techniques more efficient and powerful than those available for solving PDE. The method was found to be versatile, efficient, and easy to program using a variety of established methods for the solution of ODE. Higher order approximations to the derivations can be easily introduced, thus improving the convergence towards the true solution and enabling the solution to be carried out on a programmable hand-held calculator. The Method of Lines is also capable of handling water table profiles of various shapes as initial conditions, and other problems such as seepage flow over an inclined impervious layer. (Purdin-NWWA)
W80-04950

FLOW NETS BY THE FINITE ELEMENT METHOD,
Stone and Webster Engineering Corp., Boston, MA.
J. T. Christian.
Ground Water, Vol 18, No 2, p 178-181, March-April, 1980. 4 Fig, 9 Ref.

Descriptors: *Flow nets, *Finite-element analysis, *Computer models, Potential flow, Sheet piling, Wells, Earth dams, Anisotropy.

This paper describes how conventional finite element analyses of steady-state flow in porous media are extended to develop values of the stream function and how the resulting potential and stream function are contoured to give both plane and radial flow nets. This procedure does not apply to multiple connected regions or to regions with internal sinks or sources. Four examples are provided to illustrate the use of the method and the results obtained. They are: (1) flow beneath a sheet pile wall; (2) radial flow toward a well which is fully cased and open only at the bottom; (3) flow through an earth dam composed of two materials; (4) and flow in an anisotropic medium. In all four cases, there is close agreement between hand solutions and computer solutions. (Purdin-NWWA)
W80-05058

8. ENGINEERING WORKS

8A. Structures

DEEP EXCAVATION IN PUERTO RICO IS DEWATERED,
Paniagua, Rodriguez, Garcia and Crumley, San Juan, PR.
For primary bibliographic entry see Field 8B.
W80-04944

DIFFERENCES SEEN IN OIL AND WATER WELL DRILLING,
UOP, Inc., St. Paul, MN. Johnson Div.
R. E. Allred.
Johnson Driller's Journal, Vol 51, No 6, p 7-8, November-December, 1979. 1 Fig.

Descriptors: *Water wells, *Oil wells, *Technology, Design, Construction, Well screens, Depth, Drilling, Gravel packing, Corrosion, Production.

Similarities and differences between oil and water well drilling are examined. Both use direct rotary drilling methods, but while water well rigs can drill to 2000 feet, the much larger oil well rigs can drill more than 10 times as deep. The technique of directional drilling is commonly used for oil wells but is not usually necessary for water wells. Oil wells that produce from more than one zone require sealed packers and separate production tubing whereas multiple-aquifer water wells are simply screened through each production interval. Methods of casing, cementing, and gravel packing in the wells can also differ. In very deep holes, oil production zones might be left uncased. During gravel packing of oil wells, cross-over tools are used in placing the gravel around the production screen. The size of this gravel is 10 to 12 times the formation size while water well design criteria call for gravel 5 to 6 times formation size. The corrosive environment and high temperatures of deep oil wells requires corrosion-resistant casing and screen. Two types of screen are manufactured for oil wells: a rod-base (pipeless) screen for maximum hydraulic efficiency and a pipe-base screen for maximum strength. (Purdin-NWWA)
W80-04945

AN ECCENTRIC REDUCER WAS THE ANSWER,
UOP, Inc., Thorofare, NJ. Johnson Div.
J. S. Miller.
Johnson Driller's Journal, Vol 51, No 6, p 8-9, November-December, 1979. 1 Fig.

Descriptors: *Water wells, *Repairing, *Joints(Connections), Well screens, Cooling water, Borehole cameras.

Extensive sand pumping in a well supplying cooling water was thought to be due to a break in the casing or screen. A downhole camera survey revealed that the screen and riser had been run without centering guides, and the riser had been sealed to the casing off center with a lead shot. A new liner screen was installed by using an eccentric reducer which centered the screen on the riser. (Purdin-NWWA)
W80-04965

EFFLUENT DISPOSAL METHODS,
Delta Well Co., Inc., Ronkonkoma, NY.
R. Schockley.
Ground Water Heat Pump Journal, Vol 1, No 1, p 27-28, Spring, 1980. 2 Fig.

Descriptors: *Injection wells, *Waste water disposal, Effluents, Cooling water, Design, Well spacing, Piping systems(Mechanical), Maintenance, Rehabilitation, Heat pumps, Ground water, Heating, Cooling.

The most common method of disposal of heat pump effluent is through injection wells. Injection wells should be designed for twice the capacity of the supply well, and a slight backpressure. Periodic maintenance and redevelopment should be performed. The injection well should be located downgradient from the supply well and at a far enough distance to avoid thermal interaction between the two wells. The proper design of the piping system includes installation of a filter and a pressure gauge in the injection line, and a connection to the injection well that provides full access to the well for development. Reversing the flow in summer and winter results in automatic redevelopment of the injection well. (Purdin-NWWA)
W80-05019

PRECISION DRILLING FOR DAM SAFETY.
Ground Water Age, Vol 14, No 8, p 37-38, April, 1980.

Descriptors: *Rotary drilling, *Foundations, *Bench marks, Surveying instruments, Dams, Safety.

The Test Drilling Service Company was contracted by the U.S. Army Corps of Engineers to drill precise foundation holes for dam survey monuments in the alluvial region around the Mississippi River and its tributaries. The drilling crew switched from air rotary to mud rotary drilling when they encountered layers of unconsolidated till and a loose gravel aquifer just above bedrock. The mud pump was modified to operate with compressed air. Hole deviation was kept within one percent of vertical, using a roller stabilizer right behind the bit. With a fixed monument, the

Corps believes that trilateration surveys will provide unprecedented precision in determining very small movements in dam and lock structures, and thus, an important advance in dam safety survey methodology. (Purdin-NWWA)
W80-05055

IMPROVING YIELDS OF OPEN WELLS IN CONSOLIDATED ROCKS USING EXTENSION DRILLING TECHNIQUES,
Geraghty and Miller, Inc., Annapolis, MD.
V. W. Uhl, Jr.
Ground Water, Vol 18, No 2, p 175-177, March-April, 1980. 2 Fig, 1 Tab.

Descriptors: *Drilling, *Dug wells, *Irrigation wells, Water wells, Water yield improvement, India, Water table aquifers, Bedrock, Technology, Economics, Feasibility.

Recent demands for increased food production in India have required improving yields of irrigation wells using extension drilling. This technique consists of drilling 1.5 to 2-inch diameter holes to depths of 50 feet starting at or near the bottom of hand-dug open wells in consolidated rock. This is accomplished using a drilling system composed of a jack hammer, drill rods, and tungsten carbide bits powered by compressed air. Air or water is passed through the hollow drill rods to flush cuttings from the hole. Before drilling, the open well is dewatered using a sump pump. If a vertical hole is to be drilled, a few feet of 2.5-inch diameter casing are installed and drilling is then carried out using a 1.5 to 2-inch diameter bit. The optimum location for drilling in open wells in shallow water table aquifers is at topographic low areas or ground water discharge areas where hydraulic potentials increase with depth, and where fracturing is usually more intensive. Extension drilling is both technologically and economically feasible for farmers owning medium to small size (1 to 10 acres) farms. (Purdin-NWWA)
W80-05057

USING NONMETALLIC CASING FOR GEOTHERMAL WELLS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8G.
W80-05063

BACTERIA: WHAT'S IN THE WATER.,
National Water Well Association, Worthington, OH.
S. Smith.
Water Well Journal, Vol 34, No 4, p 88-89, April, 1980.

Descriptors: *Bacteria, *Water pollution treatment, *Ground water, Iron bacteria, Sulfur bacteria, Coliforms, Chlorination, Water pollution sources, Disinfection, Water analysis, Testing procedures, Pathogenic bacteria, *Well spacing, *Well casings.

Proper location and construction of wells will help prevent ground water pollution. Lack of horizontal distance from a potential source of contamination can be compensated for by drilling to a suitable depth. Anything inserted into a well has the potential to contaminate ground water by iron and sulfur bacteria. Disinfection of well equipment with chlorine can reduce this potential. Iron and sulfur bacteria cause a disagreeable taste and odor. Coliform bacteria can be detected only with a multiple-tube fermentation (MPN) or membranous filter test. These tests should be performed by trained technicians using proper techniques and sterile test equipment in a state-licensed lab. Iron and sulfur bacteria are readily removed by proper chlorination. Fecal contamination is more difficult to remove. First the source of contamination must be located and eliminated. The aquifer may be decontaminated with short-term superchlorination followed by development. However, if the aquifer is extensively polluted, the water supply should be treated or a new aquifer located. (Purdin-NWWA)
W80-05064

WATER DISTRICT'S NEEDS ARE MET,
UOP, Inc., St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 4B.
W80-05082

WELL MAINTENANCE PROGRAMS CAN PREVENT FAILURES,
UOP, Inc., St. Paul, MN. Johnson Div.
R. L. Moore.
The Johnson Drillers Journal, Vol 52, No 1, p 4-7, January-February, 1980.

Descriptors: *Water wells, *Failure(Mechanics), *Maintenance, Sand pumping, Corrosion, Scaling, Pumps, Chemical degradation, Electrolysis, Well casings, Well screens, Collapse, Clogging, Inspection, Monitoring.

The deterioration of a well is usually gradual and predictable. A well may fail through sand pumping, corrosion, incrustation or by a breakdown in the pumping equipment. Sand pumping can occur in semi-consolidated or unconsolidated formations and is usually the result of poor screen design in new wells or corrosion in older wells. Corrosion can be due to chemical action or electrochemical action. Besides sand pumping, corrosion causes loss of strength and resulting collapse, and redeposition of corrosion products resulting in reduced yield. Chemical corrosion is found in low pH, low TDS environments, while in high pH, high TDS environments electrochemical corrosion occurs along with incrustation. Incrustation also occurs due to sharp pressure reductions near the screen causing precipitation of calcium carbonate or iron compounds. Deterioration of the well or pump can be detected early by periodic inspection and monitoring. Once the problem is identified, a regular program of preventive maintenance will insure a constant, reliable source of water for many years. (Purdin-NWWA)
W80-05084

8B. Hydraulics

FORCE FLUCTUATIONS ON SILL OF HYDRAULIC JUMP,
University of Manchester Inst. of Science and Technology (England). Dept. of Civil and Structural Engineering.
R. Narayanan, and L. S. Schizas.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15368, p 589-599, April 1980. 20 Fig, 9 Ref, 2 Append.

Descriptors: *Hydraulics, *Loads(Forces), *Energy dissipation, *Hydraulic jump, Flow, Fluctuations, Baffles, Energy, Turbulence, Drag, Model studies, Hydraulic models, Measurements, Instrumentation, Analysis, Data collections, Laboratory tests, Dimensional analysis, Hydraulic structures, Sills.

Fluctuations of force exerted on the sill of a forced hydraulic jump were measured and presented in terms of their root-mean-square values. Experiments involved a wide range of flow conditions, various distances of the sill from the efflux, and four different heights of the sill. Maximum intensity of force fluctuations occurs when the toe of the jump begins to be sensitive to the depth downstream of the sill. Under those conditions, the spectra of fluctuations exhibit a dominant frequency. At high submergence the intensity depends essentially on the height of the sill. (Humphreys-ISWS)
W80-04834

EXPERIMENTAL DETERMINATION OF THE VELOCITY GRADIENT IN TWO DIMENSIONAL TURBULENT FLOW,
Vanderbilt Univ., Nashville, TN.
S. D. Harris, J. W. Williamson, and R. H. French.
Journal of Hydraulic Research, Vol 18, No 1, p 25-33, 1980. 4 Fig, 3 Ref.

Descriptors: *Turbulent flow, *Flow characteristics, *Instrumentation, Velocity, Laboratory tests, Design, Turbulence, Measurement, Analytical techniques, Current meters, Hydraulics, Calibrations, *Velocity gradients, Velocity profiles.

Most experimental values of the velocity gradient, du/dy, in turbulent flow have been determined indirectly by first obtaining an experimental velocity profile and then graphically differentiating this profile. Thus, du/dy reflects errors made in measuring the velocity profile and errors made in obtaining the derivative of this profile by graphical techniques. Hence, the accuracy of du/dy and the subsequent mixing lenght and transfer coefficient calculations could be improved if an experimental method of obtaining du/dy directly in fully-developed, two-dimensional, turbulent boundary layer flow were available. The design of the gradient transducer involved the careful consideration of how airfoils generate lift. After testing several possible shapes, a satisfactory airfoil was devised. This airfoil was 3.81 cm.(1.5 in.) long and had a chord length of 1.905 cm.(0.75 in.). Its leading edge was rounded and its maximum thickness was 0.13 cm.(0.05 in.). The thickness decreased uniformly to a sharp, trailing edge. The lift force exerted on this airfoil was in the expected direction. The device was calibrated in a rectangular duct, and the results clearly demonstrate the validity of the design and the feasibility of measuring du/dy directly and accurately. (Humphreys-ISWS)
W80-04836

OSCILLATOR-MODEL APPROACH TO THE IDENTIFICATION AND ASSESSMENT OF FLOW-INDUCED VIBRATIONS IN A SYSTEM,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
E. Naudascher, and D. Rockwell.
Journal of Hydraulic Research, Vol 18, No 1, p 59-82, 1980. 12 Fig, 12 Ref.

Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, *Flow control, *Reviews, Flow system, Hydraulic structures, Flow characteristics, Mathematical models, Analytical techniques, Analysis, Dynamics, Drag, Frequency stabilizers, Flow system, Resonance, Sluice gates, Vortices, Surges, Standing waves, Flow-induced vibrations, Flow instability, Oscillations, Cylinders.

A scheme was presented for classifying problems of flow-induced vibrations according to basic types of excitation (extraneously, instability-, and movement-induced excitation) and basic flow modules. It was shown that vibrations in a complex system can be treated by a lumped-parameter approach using oscillator equations for the structures or structural parts, the unstable flows, and the possible fluid oscillators (surges or standing waves) within the system. A valve-conduit-surge-tank system was used to exemplify that this approach can be applied to assess dangerous spots and operating conditions in a system, to formulate vibration-prevention measures, and to analyze the first-order system behavior. The drawbacks of the current oscillator models are mainly due to their heuristic derivation and the necessary trial-and-error adjustments to available experimental evidence. An important task for future research would be to attempt a derivation of the flow- and fluid-oscillator models as a function of clearly identifiable flow processes and flow/structure interactions. (Humphreys-ISWS)
W80-04838

A NEW MEASURING DEVICE FOR QUICKLY VARYING LIQUID LEVELS (PRINCIPE D'UN NOUVEAU DISPOSITIF DE MESURE DES NIVEAUX DE LIQUIDES),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
For primary bibliographic entry see Field 7B.
W80-04839

TRANSPORT PROCESSES OF PARTICLES IN NON-DILUTE SUSPENSIONS IN TURBULENT WATER FLOW- PHASE I: EXPERIMENTAL MEASUREMENTS,
Illinois Univ. at Urbana-Champaign. Dept. of Nuclear Engineering.

B. G. Jones, and J. E. Gronager.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-180946, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 148, March 1980. 189 p, 76 Fig, 10 Tab, 37 Ref. OWRT A-085-ILL(1), 14-34-001-8015.

Descriptors: *Turbulent transport, *Dispersion, *Sedimentation, *Slurry, *Particle suspension, Turbulent flow, Particle shape, Particle size, Particle transport, Model studies, Suspended solids.

Increased utilization of non-dilute, solid-fluid suspensions in transporting materials and in estimating the distribution of particles from atmospheric fallout, demands that the basic fluid-particle interactions be thoroughly understood. Our previous studies of such interactions were conducted only on dilute suspensions, where as this study has been conducted in the same vertical flows but with solid spherical particle suspensions with concentrations, phi, from 0 to 10 percent by volume, a range of practical interest to sedimentation and erosion as well as in slurry pipelines. Detailed experimental results of the particle-fluid relative mean and rms velocities as well as particle dispersion were obtained for two particle densities and several phi values. Both particle types showed a rapid rise of both relative mean and rms velocities as phi increased to about 1-2 percent and fell off gradually for higher phi values. Dispersion followed a similar behavior. The higher free fall velocity particles exhibited larger rms velocities and increased dispersion from the lighter, lower free fall velocity particles. Analytical models of the phi-dependence showed good agreement with the data, suggesting their use in engineering predictions.
W80-04866

SURCHARGE OF SEWER SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, and N. Pansic.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-181233, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 149, March 1980. 66 p, 20 Fig, 7 Tab, 55 Ref. OWRT A-086-ILL(2), 14-31-0001-8015.

Descriptors: *Drainage systems, *Sewers, *Storm drains, *Unsteady flow, Computer models, Pipe flow, Conduit flow, Flood routing, Hydraulics, Hydrographs, Mathematical models, Open-channel flow, Sewer systems, Storm runoff, Urban drainage, Urban runoff.

Surcharge of a sewer is the situation in which the sewer entrance and exittare submerged and the pipe is flowing full and under pressure. In this report the hydraulics of the surcharged flow as well as the open-channel flow leading to and after surcharge is discussed in detail and formulated mathematically. The transition between open-channel and surcharge flows is also discussed. This information is especially useful for those who intend to make accurate advanced simulation of sewer flows. In this study an approximate kinematic wave - surcharge model called SURKNET is formulated to simulate open-channel and surcharge flow of storm runoff in a sewer system. An example application of the model on a hypothetical sewer system is presented.
W80-04867

AQUIFERS STORE ENERGY.
For primary bibliographic entry see Field 3C.
W80-04940

DEEP EXCAVATION IN PUERTO RICO IS DEWATERED,
Paniagua, Rodriguez, Garcia and Crumley, San Juan, PR.
A. R. Crumley.
The Johnson Driller's Journal, Vol 51, No 6, p 4-6, November-December, 1979. 3 Fig.

Descriptors: *Dewatering, *Excavation, *Well points, *Puerto Rico, Water wells, Water table, Artesian aquifers, Drainage, Permeability, Aquifer testing.

Seven, deep, high-capacity wells were used to dewater an excavation 43 feet below the ground water table. In-situ testing of site permeability revealed variations by several orders of magnitude. This necessitated full-scale pumping tests lasting for seven days. These tests indicated that certain sections of the aquifer were under artesian conditions. Thus, during excavation pockets of trapped water were encountered. The number of wells and the pumping rate from each were carefully adjusted to attain optimum performance. Seven, 80-feet-deep, 12-inch-diameter wells were installed, each pumping 1200 gpm. Wire-wound stainless steel screens were used due to high flow rates and the possibility of corrosion and incrustation. Seven diesel pumps were maintained daily to ensure that at least six were always in operation. Final flows with the excavation fully dewatered were 800 gpm per well. (Purdin-NWWA)
W80-04944

FLOW NETS BY THE FINITE ELEMENT METHOD,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 7C.
W80-05058

8C. Hydraulic Machinery

EARLY PRESSURE SYSTEMS: THE WATER RAM,
Ridgetown Coll. of Agricultural Tech. (Ontario).
C. S. Baldwin.
Canadian Water Well, Vol 6, No 1, p 25, February, 1980. 1 Fig.

Descriptors: *Hydraulic ram, *Pumps, Water storage, Costs, Maintenance.

The water ram is a device for pumping water by means of waterpower connected with a spring, pond or creek with a minimum flow of 1 1/2 gallons per minute and a minimum fall of 18 inches. The ram can pump to a height of 25 feet for every foot of fall in the stream. Since the moving parts are minimal, the ram has low initial cost and runs for years without maintenance. Most of the cost is in the piping from the ram to a storage tank. (Purdin-NWWA)
W80-04952

SUBMERSIBLE PUMPS--FIELD SERVICE,
K. George.
Canadian Water Well, Vol 6, No 1, p 22-24, February, 1980. 5 Fig, 1 Tab.

Descriptors: *Submersible pumps, *Servicing, *Maintenance, Failure(Mechanics), Electric power failure, *Pumps, Electrical equipment, Water wells.

Submersible pumps have greater reliability and efficiency, are easier to install, and cost less than jet pumps and line shaft driven pumps. Most submersibles require little or no periodic maintenance. However, when service is required, a systematic above-ground checking procedure should be followed to avoid the cost of unnecessarily pulling the pump. Checking procedures are listed for the most frequent problems. Repeated failures of pump, cable or motor indicate installation problems which should be corrected. These common causes for failure are listed. Proper well construction and installation plus a well-designed submersible pumping system are necessary to ensure a reliable and lasting water supply. (Purdin-NWWA)
W80-04953

DESIGN OF A COST EFFECTIVE SOLAR POWERED WATER PUMP,
Utah Water Research Lab., Logan.
D. G. Chadwick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182819, Price codes: A03 in paper copy, A01 in microfiche. Hydraulics and Hydrology Series UWRL/H-80/02, April 1980. 36 p, 33 Fig, 2 Tab, 2 Append. OWRT-A-036-UTAH(1), 14-34-0001-8047.

Descriptors: *Solar radiation, *Pumps, *Cost-benefit analysis, *Design criteria, Solar power, Water pumps, Technology, Testing.

The design and performance of a vacuum lift, solar powered water pump is discussed. The basic design consists of an expanding gaseous piston confined inside a chamber which is located in series with, and between, an inlet and an outlet check valve. The gas is generated by volatilizing cyclopentane or hexane. Four variations of this basic design concept were built and evaluated. The various features of each are discussed. Considerations in the choice of a cost-effective solar collector are also reviewed. Several of the more promising types of solar collectors were built and evaluated for use on the pump. A 70C heat source temperature is required to operate the pump if cyclopentane is used as the volatile fluid, 90C is required if hexane is used. The volatile fluid is not expended in the pumping process. The pumps constructed on this project have a capacity of approximately 6 liters/minute when pumped to a height of 2 meters. Two square meters of sunshine are sufficient to operate the pump.
W80-05011

A TECHNICAL EXAMINATION OF GROUND WATER GEOTHERMAL HEAT PUMP COMPONENTS,
Friedrich Air Conditioning and Refrigeration Co., Fort Lauderdale, FL.
W. M. Hughes.
Ground Water Heat Pump Journal, Vol 1, No 1, p 14-15, Spring, 1980. 2 Fig.

Descriptors: *Heat pump, *Design, *Equipment, Temperature control, Heating, Cooling, Coolants, Condenser, Evaporators, Valves, Ducts, Heat exchangers, Ground water.

The heat pump cycle allows the same ground water to be used as either a sink or a source depending on whether heating or cooling is required in the space. The reason that this can be done is that the heat is transferred into and out of a refrigerant (commonly Freon). A heat pump functions by first evaporating the Freon at low temperature (and pressure) in an evaporator where air is cooled. A compressor then compresses the cold vapor into a hot, high-pressure vapor. This hot vapor condenses into a warm liquid in a condenser. The heat that is released by the Freon goes into the water. The liquid Freon goes through an expansion device causing a drop in pressure and a corresponding temperature drop. Most heat pumps contain a reversing valve which changes the routing of the Freon inside the unit so that either heating or cooling can be produced. A blower draws the return air through a filter and over the coil and discharges the cooled or heated air into the ductwork where it is distributed throughout the building. Optional heat pump components include an auxiliary electric resistance heating unit for supplementary or backup heat and a desuperheater water heater. (Purdin-NWWA)
W80-05051

WELL MAINTENANCE PROGRAMS CAN PREVENT FAILURES,
UOP, Inc., St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W80-05084

8G. Materials

USING NONMETALLIC CASING FOR GEOTHERMAL WELLS,
National Water Well Association, Worthington, OH.
W. H. Purdin.
Water Well Journal, Vol 34, No 4, p 90-91, April,

1980. 1 Tab.

Descriptors: *Well casings, *Plastic pipe, *Geothermal studies, *Drilling, Wells, Physical properties, Thermal properties, Chemical properties, Cost comparisons, Corrosion control, Rotary drilling, Collapse, Safety.

Various nonmetallic well casings can be used to help reduce the cost of installation maintenance and replacement of geothermal wells. The physical, thermal, and chemical properties and costs of these casings are compared. Thermoplastic casings cost less and have greater chemical resistance but less thermal resistance and structural strength than thermosetting plastic casings. Of the 'nonplastic' casings, polymer concrete has the best rating. The many advantages of these materials far outweigh their disadvantages. Because of their light weight, drilling cost is reduced. In some cases, the cost of the casing may be less than half as much as steel casing. Drilling geothermal wells and installing nonmetallic casing requires special precautions. Cable tool rigs should not be used with nonmetallic casing since it can't be driven. Casing can collapse due to bridging and subsequent collapse of the gravel pack, heat of hydration during grouting, or surging during development. Also, it may perform well for several years but suddenly collapse due to ground subsidence or high formation temperatures. Several steps are outlined to avoid collapse. (Purdin-NWWA)
W80-05063

8I. Fisheries Engineering

AQUATIC STUDIES OF THE YELLOWSTONE RIVER,
Montana Fish and Game Dept., Helena. Environment and Information Div.
P. J. Graham, R. F. Penkal, and L. Peterman.
Report No REC-ERC-79-8, July 1979. 88 p, 60 Fig, 12 Tab, 39 Ref, 2 Append.

Descriptors: *Fish migration, *Sauger, *Walleye, *Diversion structures, Spawning, Fish barriers, Fish behavior, Fish populations, Fish passages, Fish reproduction, Electro-fishing, Turbulence, Streamflow, Regulated flow, Yellowstone River(Mont), Montana.

The effects of streamflow alterations on sauger and walleye populations in the lower Yellowstone River were studied. These fish were selected for the study due to their movement related to spawning, feeding, over-wintering, and other biological activities. The lower half of the river from the mouth of the Big Horn River downstream to the North Dakota border was the area investigated. There are two major diversions along this reach, the Forsyth diversion, a concrete structure across the entire river that creates a 0.5-m vertical drop, and the Intake diversion, a wooden structure covered by boulders extending across the main channel creating a turbulent 1.2-m drop in 30-m. Both structures divert water for irrigation. Fish samples were taken both upstream and downstream from each diversion. Fish were collected by boom electrofishing from a flatbottomed aluminum boat. Fish length, mass, and sex were determined and the fish were tagged and released near the middle of each section. Fish tag return data were collected and grouped by fish recapture time. Results show that walleye migrated upstream to the Intake diversion, spawned, and went back downstream. Sauger similarity concentrated below each diversion but their migration over the Intake diversion was extensive. Few sauger and no walleye migrated over the 0.5-m vertical drop of the Forsyth diversion. Fish were progressively more abundant in downstream sections. Egg abundances were also studied. (Seigler-IPA)
W80-04880

THE LAW OF THE SEA AND REGIONAL FISHERIES POLICY,
South Pacific Commission, Noumea (New Caledonia).
For primary bibliographic entry see Field 6E.
W80-04971

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

IDENTIFYING AND MEETING TRAINING NEEDS FOR PUBLIC PARTICIPATION RESPONSIBILITIES IN WATER RESOURCES PLANNING,
Massachusetts Univ., Amherst. Water Resources Research Center.
M. O. Ertel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182827, Price codes: A03 in paper copy, A01 in microfiche. Publication No 107, 1979. 32 p, 4 Tab, 25 Ref, 2 Append. OWRT B-063-MASS(1), 14-34-001-8090.

Descriptors: *Public participation, *Social participation, *Training, *Water resources development, Planning, Comprehensive planning, Social aspects, Political aspects, Universities.

Legislative mandates are increasingly assigning to water resources planning agencies the responsibility for conducting public participation programs. Few planning programs, however, have the resources to employ professionals with specialized training in the types of skills that are crucial to successful public participation programming, and planners themselves are often required to perform this function in addition to other duties. This project has documented the extent of this situation through a survey of planners in Coastal Zone Management and '208' programs in New England. The survey also determined these practitioners' educational and experiential preparation for performing public participation functions, as well as their own perceptions of the relative importance of those functions and the adequacy with which they were carried out. The research indicates that prior experience is more directly related to perceived adequacy than either academic or experiential background and therefore concludes that all planners should receive, as part of their professional preparation, specific training that will give them a viable substitute for this experience before they begin their professional careers. Recommendations for such a curriculum, stressing the importance of the development of public communications skills, are provided. (Godfrey-Mass)
W80-05015

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1978.
Geological Survey, Reston, VA.
January 1980. 244 p.

Descriptors: *Sedimentation, *Data collections, *Water Resources Development, *Federal government, Tennessee Valley Authority, Engineering, Research and Development, Publications, Water resources, Sediment control, Sediment transport, Dredging, Desilting.

Information in the field of sedimentation on: the activities of Federal agencies, work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent data are reported for 1978. The report is organized by 21 major drainage areas in the conterminous United States, Alaska, Hawaii, Puerto Rico, and some foreign areas. Departments and agencies involved in sedimentation activities include: in the Department of Agriculture, the Forest Service, the Science and Education Administration, and the Soil Conservation Service; in the Department of the Army, the Corps of Engineers; in the Department of Commerce, the National Oceanic and Atmospheric Administration; in the Department of Energy, the Federal Energy Regulatory Commission; in the Department of the Interior, the Bureau of Mines, the Bureau of Reclamation, and the Geological Survey; in the Department of Transportation, the Federal Highway Administration; and the Tennessee Valley Authority. Not all agencies are active in all regions. A map illustrating the water resources regions of the United States is included. (Seigler-IPA)
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*U.S. GOVERNMENT PRINTING OFFICE : 1980 O-311-059/2

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 16
AUGUST 15, 1980

W80-05101 -- W80-05400
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 16
AUGUST 15, 1980

W80-05101 -- W80-05400

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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05 WATER QUALITY MANAGEMENT AND PROTECTION

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09 MANPOWER, GRANTS, AND FACILITIES

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

CONCENTRATION AND FRACTIONATION OF HYDROPHOBIC ORGANIC ACID CONSTITUENTS FROM NATURAL WATERS BY LIQUID CHROMATOGRAPHY,
Geological Survey, Lakewood, CO. Water Resources Div.
E. M. Thurman, and R. L. Malcolm.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.25. Geological Survey Water-Supply Paper 1817-G, 1979. 16 p, 4 Fig, 2 Tab, 13 Ref.

Descriptors: *Distillation, *Organic acids, *Chromatology, *Adsorption, *Analytical techniques, Water properties, Instrumentation, Methodology, Separation techniques, Gels, Hydrogen ion concentration, Fulvic acids, Phenols, Humic acids, Conductivity, *Liquid chromatography, Hydrophobic organic acids.

A scheme is presented which uses adsorption chromatography with pH gradient elution and size-exclusion chromatography to concentrate and separate hydrophobic organic acids from water. A review of chromatographic processes involved in the flow scheme is also presented. Organic analytes that appear in each aqueous fraction are quantified by dissolved organic carbon analysis. Hydrophobic organic acids in a water sample are concentrated on a porous acrylic resin. These acids usually constitute approximately 30 to 50 percent of the dissolved organic carbon in an unpolluted water sample and are eluted with an aqueous eluent (dilute base). The concentrate is then passed through a column of polyacryloylmorpholine gel, which separates the acids into high- and low-molecular-weight fractions. The high- and low-molecular-weight eluates are reconcentrated by adsorption chromatography, then are eluted with a pH gradient into strong acids (predominately carboxylic, acids) and weak acids (predominately phenolic compounds). For standard compounds and samples of unpolluted waters, the scheme fractionate humic substances into strong and weak acid fractions that are separated from the low molecular weight acids present. A new method utilizing conductivity is also presented to estimate the acidic components in the methanol fraction. (Kosco-USGS)
W80-05301

2. WATER CYCLE

2A. General

HYDROLOGIC CHARACTERISTICS OF AUSTRALIAN STREAMS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-05120

POINT BAR AND FLOODPLAIN FORMATION OF THE MEANDERING BEATTON RIVER, NORTHEASTERN BRITISH COLUMBIA, CANADA,
Wollongong Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W80-05144

VERIFICATION OF MATHEMATICAL AND PHYSICAL MODELS IN HYDRAULIC ENGINEERING.
Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978. American Society of Civil Engineers, New York, 1978. 887 p.

Descriptors: *Conferences, *Hydraulics, *Mathematical models, *Hydraulic models, *Model studies, *Statistical models, Hydraulic engineering, Groundwater, Open channel flow, Calibrations, Groundwater movement, Roughness(Hydraulic), Natural streams, Aquifers, Porous media, Open channels, Water management(Applied), Navigation, Land use, Estuaries, Tidal waters, Hydraulic structures, Lakes, Rivers, Watersheds(Basins), Runoff, Analytical techniques, Analysis, Numerical analysis, Unsteady flow, Sediment transport, Thermal plumes.

The purpose of this conference was to focus attention on verification of mathematical and physical models in hydraulic engineering. Subject areas covered by the 96 papers included: societal obligations of a people-serving profession, current practices and data basis for the verification of effluent models, flow model calibration, groundwater model calibrations or parameter identification, modeling for water quality management, models for navigation project planning, application of groundwater models to actual field situations, modeling of tidal and estuarine circulation and water quality problems, computational hydraulics, water quality analysis, modeling of prototype testing of submerged hydraulic structures in a lake regime, prototype verification of models for hydraulic structures, tidal hydraulics, unsteady flow, sediment models, hydrologic models, and land use models. (See W80-05160 thru W80-05241) (Humphreys-ISWS)
W80-05159

SEDIMENT MOVEMENT IN A SMALL HUMID WATERSHED,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 2J.
W80-05220

A SEDIMENT YIELD ROUTING MODEL,
Science and Education Administration, Temple, TX.
For primary bibliographic entry see Field 2J.
W80-05221

FIELD TEST OF A DISTRIBUTED SEDIMENT YIELD MODEL,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2J.
W80-05222

APPLICATION OF COSSARR MODEL IN CENTRAL JAVA,
Engineering Consultants, Inc., Denver, CO.
Y. Au-Yeung, J. Loebis, and S. Komarawinata.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 715-722, 1978. 3 Fig, 7 Tab, 2 Ref.

Descriptors: *Model studies, *Watersheds(Basins), *Hydrologic systems, *Synthetic hydrology, Streamflow, Hydrology, Computer models, Runoff, Soil moisture, Evapotranspiration, Base flow, Infiltration, *Java, Model calibration.

The watershed model portion of the COSSARR model provided a useful tool in streamflow extension for three river basins in central Java. The successful use of the model, like all other hydrologic models, is determined largely by the quantity and quality of the available data as demonstrated by the difference in the computed runoff volumes from using only four years of mean daily flow data as compared with six years of actual flow data in the Lukulo watershed. Without a reasonable lenght of concurrent observed streamflow data and observed rainfall data, the accuracy of the model verification is difficult and uncertain. Another difficulty involved in applying the model was in the filling and adjusting the missing rainfall data for period when localized thunderstorms produce most of the rainfall. Four years of observed hydrologic data is too short a period to adequately verify the runoff-rainfall relationship of any watershed, therefore, it was planned to recalibrate the model in 1980. One hopes there will be at least ten years of observed hydrologic data for better model calibration. (See also W80-05159) (Humphreys-ISWS)
W80-05226

UPPER ST. JOHNS RIVER BASIN WATER MANAGEMENT MODEL,
St. Johns River Water Management District, Palatka, FL. Engineering Div.
C. C. Tai.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 729-736, 1978. 4 Fig, 4 Ref.

Descriptors: *Water management(Applied), *Florida, *Model studies, *River basins, Hydrologic systems, Watersheds(Basins), Runoff, Water balance, Management, Hydrograph analysis, Base flow, Rainfall, Evapotranspiration, Computer models, Soil water, Surface runoff, Infiltration, Analytical techniques, *St. Johns River(FL).

The Upper St. Johns River Basin covers a drainage area of about 2,000 square miles in east central Florida within the boundary of the St. Johns River Water Management District. The main river channel runs northerly with an average hydraulic gradient of 0.16 feet per mile for about 95 miles from the headwater near Melbourne. The Upper St. Johns Basin Model (USJM) has been developed with special consideration given to the extraordinary hydrologic features of the basin. The model was organized so that the hydrologic responses resulting from any change in each element of the project works could be generated. The USJM consists of two major components, namely the USJ runoff model and the USJ routing model. The runoff model generates the runoff hydrograph for each discrete land area from input rainfall data. The routing model modifies this hydrograph by considering the impoundment and transient lag time effects to produce an inflow hydrograph into the main river, and finally computes the discharge hydrograph for each river reach. The valley flow will be simulated with partial differential equations written for overland flow over a grid mesh. The model has been used to simulate two planning units and has produced favorable results. The actual simulation run of the entire Upper St. Johns River Basin has not been performed because the total required data is not yet available. (See also W80-05159) (Humphreys-ISWS)
W80-05227

THE EFFECT OF PRECIPITATION PATTERNS ON SURFACE RUNOFF,
California State Dept. of Water Resources, Sacramento.
R. H. Zettlemoyer.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 776-782, 1978. 4 Fig, 4 Ref.

Descriptors: *Precipitation(Atmospheric), *Distribution patterns, *Model studies, *Surface runoff, *California, Hydrology, Runoff, Annual, Analysis, Simulation analysis, River basins, Evaporation, Watersheds(Basins), *Mattole River(CA).

A general hydrologic model was used to evaluate the effect on annual runoff due to variations in precipitation throughout the year. The Mattole River basin in a humid region of California was calibrated to a 15-year period, and then annual rainfall totals were made equal to the minimum, median, and maximum annual totals of the calibration period. The simulation showed that favorable patterns could produce up to 10% greater runoff than an average year, and conversely unfavorable patterns could produce 10% less runoff than a typical year for the Mattole basin. Caution is recommended in extrapolating to other hydrologically different areas. Model studies as described can be useful when verifying water supply forecasts. Another application includes the preparation of water supply forecasts that are based on long-range weather forecasts which contain only trend type

precipitation information. (See also W80-05159) (Humphreys-ISWS)
W80-05233

LINEARIZED SUBHYDROGRAPHS URBAN RUNOFF MODEL,
Akron Univ., OH. Dept. of Civil Engineering.
S. Sarikelle, J-S. Chien, and G. L. French.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 783-790, 1978. 6 Fig, 6 Ref.

Descriptors: *Model studies, *Urban runoff, *Hydrograph analysis, *Cities, Mathematical models, Analytical techniques, Analysis, Runoff, Urban hydrology, Hyetographs, Methodology, Runoff coefficient, Watersheds(Basins), Rainfall-runoff relationships, Simulation analysis, Storm water, Linearized subhydrographs method.

A model for the simulation of urban runoff based on the Linearized Subhydrographs Method was verified for the planning and analysis of converging stormwater drainage systems in urban areas. The model simulates hydrographs for continuously recorded rainstorm events as applied to different watersheds of various sizes. The model was applied to various urban watersheds with differing land use characteristics utilizing recorded hyetographs. The simulated hydrographs were then compared to recorded hydrographs. The results indicate that when continuous event hyetographs are utilized, the simulated hydrographs compare well to those results obtained from measured values. (See also W80-05159) (Humphreys-ISWS)
W80-05234

ASSESSING LAND USE CHANGES WITH AN URBAN RUNOFF MODEL,
North Virginia Planning District Commission, Falls Church.
H. A. Bonuccelli, and J. P. Hartigan.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 827-835, 1978. 3 Fig, 9 Ref, 1 Append.

Descriptors: *Urban runoff, *Land use, *Model studies, *Effects, Cities, Watersheds(Basins), Management, Hydrographs, Planning, Hydrologic aspects, Environment, Decision making.

The dissemination of reports on successful applications of urban runoff simulation models in 'real-world' settings can be expected to bring about more widespread adoption of computer modeling techniques by the public sector. This paper provided such a case study. It described a regional stormwater management program that has successfully incorporated computer modeling techniques into local decision-making processes. The use of a verified model as an ongoing planning tool in the Four Mile Run Watershed Management Program has yielded many important benefits. It has allowed public works officials in four political subdivisions to view the watershed as an integrated system and has eliminated the traditional 'piecemeal' approach to drainage improvements in the watershed. By addressing complex hydraulic interactions in the watershed, it has enabled the local jurisdictions to determine the downstream impacts of developments throughout the basin. It revealed the importance of a single tributary as a hydraulic control for the flood control channel and indicated that certain parts of the watershed are more sensitive to land use change than others. By demonstrating the inappropriateness of uniform detention ordinances in the basin, it has prevented the expenditure of funds on needless or harmful control measures. (See also W80-05159) (Humphreys-ISWS)
W80-05239

RUNOFF SIMULATION MODEL: APPLICATION AND VERIFICATION,
Weston (Roy F.), Inc., West Chester, PA.
D. F. Lakatos, and K. C. Wiswall.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 836-843, 1978. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Runoff, *Model studies, *Urban runoff, *Maryland, Storm runoff, Urban drainage, Flooding, Watersheds(Basins), Peak discharge, Analytical techniques, Drainage systems, Storm water, Management, *Aberdeen(MD), Penn State Runoff Model.

The initial phase of the Aberdeen, Maryland, study was a thorough investigation of the existing drainage system to provide a full description of the physical characteristics of the system. These physical characteristics are needed for accurate development of the required input for the Penn State Runoff Model. The modeling technique consisted of the following six steps: (1) Collect and analyze existing drainage system information. (2) Select the design storms and the storms needed for calibration/verification. (3) Make calibration/verification runs to determine the accuracy of model coefficients. (4) Model the existing system to pinpoint the critical flooding areas. (5) Input the alternative runoff control techniques for further model analysis. (6) Recommend a set of runoff control techniques based on modeling results and on overall costs. The case study application of this model illustrated its practicality in developing realistic control alternatives for stormwater management. The Town of Aberdeen has begun to correct those components of the two storm drainage systems that were determined to be critical enough to require short-term action. In addition, potential funding sources are being investigated in order that the required overall or long-term system-control recommendation can be implemented. (See also W80-05159) (Humphreys-ISWS)
W80-05240

COMPARISON OF STORMWATER DETENTION POLICIES,
Maryland Univ., College Park. Dept. of Civil Engineering.
G. E. Kamedulski, and R. H. McCuen.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 844-853, 1978. 4 Tab, 6 Ref.

Descriptors: *Water management(Applied), *Decision making, *Detention reservoirs, *Water policy, Storm water, Management, Model studies, Storm runoff, Mathematical models, Watersheds(Basins), Hydrology, Flood routing, Storage, Sediment discharge, Urban runoff, Stormwater detention.

A mathematical model was formulated to simulate the response of a detention basin to flow and sediment discharges. The model was calibrated using data obtained from an existing detention basin on a 47-acre watershed in Montgomery County, Maryland. The model was then used to evaluate the response of the detention basin for storms of various intensities and durations and for two land use conditions: a highly pervious, exposed soil condition, and a semipervious, exposed soil condition. Various detention basin design policies were evaluated and the effects of changes in detention basin parameters on detention basin design policies were evaluated. The use of the model resulted in several important conclusions. First, inflow volume has a significant effect on both peak discharge reduction and sediment trap efficiency. Second, hydrologic designs have traditionally been based on both a duration and a frequency. Third, the use of one return period as the basis for a detention basin design policy does not lead to a design that reflects the intent of stormwater management. Fourth, current design policies often establish the required basin storage volume independent of the design characteristics of the riser and outflow pipe. Fifth, sediment trap efficiency was dependent on the volume of inflow sediment and the volume of basin storage. In summary, detention storage is an effective means for controlling the effects on runoff of continued urban expansion. But for detention storage to provide optimum protection and to meet the intent of stormwater management policies, the design policies need to be more comprehensive than most existing policies. (See also W80-05159) (Humphreys-ISWS)
W80-05241

A DIGITAL OVERLAY TECHNIQUE FOR EVALUATION OF POTENTIAL INFILTRATION AND RECHARGE,
University of South Florida, Tampa. Coll. of Engineering.
For primary bibliographic entry see Field 4A.
W80-05261

WATER BUDGETS FOR LAKE SUPERIOR AND WHITEFISH BAY,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05281

WATER IN THE PENSACOLA, FLORIDA, AREA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Resources Investigations 79-89 (open-file report), 1979. 16 p, 8 Ref.

Descriptors: *Groundwater resources, *Surface waters, *Florida, *Water quality, *Available water, Freshwater, Rainfall-runoff relationships, Streamflow, Hydrologic budget, Aquifers, Water supply, Water utilization, Industrial wastes, Waste disposal, Cooling, Water resources development, Saline water intrusion, Water pollution, Flooding, Gulf Coastal Plain, *Pensacola area(Fla), Floridan aquifer.

The Pensacola, Florida, area, comprising Escambia and Santa Rosa Counties, has abundant water of good quality. Most of the freshwater used, about 101 million gallons per day, comes from the surficial sand-and-gravel aquifer. The deeper Floridan aquifer locally contains saltwater, and is used in places for industrial waste disposal. Surface water is used for cooling and waste disposal, but is available for additional development. Water problems around Pensacola are localized, but they include saltwater encroachment, contamination of ground water by industrial wastes, high iron concentration, corrosiveness, and nitrate in ground water, and flooding. These problems point up the need for continued monitoring of the water resource. (Kosco-USGS)
W80-05298

2B. Precipitation

COMPARISON OF GENERALIZED ESTIMATES OF PROBABLE MAXIMUM PRECIPITATION WITH GREATEST OBSERVED RAINFALLS,
National Weather Service, Silver Spring, MD.
J. T. Riedel, and L. C. Schreiner.
NOAA Technical Report NWS 25, March 1980. 70 p, 40 Fig, 5 Tab, 15 Ref.

Descriptors: *Probable maximum precipitation, *Precipitation(Atmospheric), *Rainfall, *Storms, *Meteorology, Appalachian mountain region, Gulf of Mexico, Snake River, California, North Dakota, Regional analysis, United States.

The relationship between probable maximum precipitation (PMP) estimates and observed maximum rainfalls was investigated for two regions of the U.S., east of the 105th meridian and west of the Continental Divide. Storms used in the study were those of record having point or area rainfall depths that are greater than or equal to 50% of PMP. In the East, 177 storms were identified that met this criterion and rainfall amounts were well distributed over the range of durations and area sizes. Approximately 1% of the Eastern storms were within 20% of PMP. A smaller storm sample was

obtained in the West, and detailed comparisons analogous to those in the East cannot be made. Despite this smaller Western storm sample, there were more cases in the West of greater than or equal to 50% of PMP for 10 sq mi areas (6 and 24 hours) than in the East. A rough comparability in PMP between the East and West was observed in comparisons of PMP values with the values for the 100 yr occurrence. These ratios were low in areas of frequent heavy rains such as the Cascade-Sierra slopes, the Appalachians, and the Gulf of Mexico coastal regions. Conversely these ratios were high in areas where heavy rains are uncommon such as the central valley of California, the Snake River and North Dakota. (Seigler-IPA)
W80-05114

STOCHASTIC ANALYSIS OF ANNUAL RAINFALL AFFECTED BY URBANIZATION,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao.
Journal of Applied Meteorology, Vol 19, No 1, p 41-52, January 1980. 5 Fig, 3 Tab, 7 Ref. OWRT-B-025-IND(6).

Descriptors: *Rainfall, *Stochastic processes, *Urbanization, Microclimatology, Urban hydrology, Precipitation(Atmospheric), Seasonal, Model studies, Cities, *Annual rainfall, *Stochastic analysis, Microclimate, Seasonality, Random variables, Integrated moving average, Standard error, Urban precipitation.

Investigators have shown that changes in microclimate were caused by large urban areas. Precipitation-related activity has been shown to be larger in and around urban areas than in the surrounding countryside. Seasonality of increased precipitation also has been investigated. This paper dealt with testing the significance of observed changes in the mean and in the trends of annual precipitation series of data from St. Louis, Missouri, and LaPorte, Indiana, and nearby stations. The annual rainfall series at LaPorte and St. Louis were found to be correlated. Thus, the traditional univariate and multivariate tests which were based on the assumption that the variates were independent random variables was not applicable to testing changes in the characteristics of annual precipitation data. Integrated moving average models of the annual precipitation data were used. The statistical significance of the observed changes in urban precipitation data was discussed, and a set of conclusions was presented. (Roberts-ISWS)
W80-05119

EMPIRICALLY DERIVED PROBABILITY ESTIMATES OF DROUGHT PARAMETERS FOR WESTERN UNITED STATES BACK TO 1700 A.D.,
M. P. Lawson, and D. Embry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190630, Price codes: A06 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Lincoln Project Completion Report, September 30, 1979. 99 p, 28 Fig, 6 Tab, 32 Ref, 1 Append. OWRT A-055-NEB(1).

Descriptors: *Droughts, *Probability, *Stochastic processes, *Water shortage, Precipitation(Atmospheric), Weather patterns, Mathematical models, Model studies, Dendrochronology, Dating, History, Statistical methods, Climatic data, Climatology.

The runs method of analysis, a succession of similar events preceded and succeeded by different events, was used to compare theoretical probability drought models on a regional basis with presecular time series data. Data used dated back to 1700 A.D. and came from reconstructed moisture indices, Palmer Drought Severity Indices (P.D.S.I.), computed from tree-ring indices. Parameters used in computing P.D.S.I. include evapotranspiration, recharge, runoff, moisture loss, and precipitation. The P.D.S.I. can indicate drought severity, run-sum, as well as duration, run-length. Results for the 263 year period studied show droughts ranging from 4 to 11 continuous years. Major droughts of four or more years occurred during the periods of 1710-1720, 1720-1780, 1830-1870, the 1880's, and the 1930's. Maximum drought intensities ranged from a -6.825 to a -41.643 sum of negative P.D.S.I. values for droughts of 4 to 11 years. Maximum drought intensities were compared to their durations to compute ratios of average water deficiency. These regional ratios ranged from nearly 4:1 to less than 2:1. It appears that droughts in the Western U.S. begin with a slow deficit growing to a maximum deficit followed by a slow recovery. For a 200 year period the probability of maximum drought recurrence ranged from 1 to 83% with maximum intensity ranging from 1 to 10%. (Seigler-IPA)
W80-05247

ENVIRONMENTAL CLIMATOLOGY OF LAKE SUPERIOR,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 2H.
W80-05284

STOCHASTIC ANALYSIS OF ANNUAL RAINFALL AFFECTED BY URBANIZATION,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao.
Journal of Applied Meteorology, Vol 19, No 1, p 41-52, January 1980. 5 Fig, 3 Tab, 7 Ref. OWRT B-025-IND(6).

Descriptors: *Urbanization, *Rainfall disposition, *Distribution patterns, *Weather modification, Rainfall, Local precipitation, Stochastic processes, LaPorte(IN), St. Louis(MO).

Several investigators have pointed out the changes in microclimate brought about by large urban areas. The paper deals with testing the significance of observed changes in the mean and the trends of the annual precipitation series from St. Louis, Missouri and LaPorte, Indiana and other stations in the vicinity of these stations. The annual precipitation data may not be assumed to be independent random variables because they may be correlated. For example, the annual rainfall series at LaPorte and St. Louis were found to be correlated. Consequently, the traditional univariate and multivariate tests which are based in the assumption that the variates are independent random variables may not be applicable to testing changes in the characteristics of annual precipitation data. As a result, Integrated Moving Average (IMA) models of the annual precipitation data are used in the study. The posterior distributions of the parameters of the IMA models were obtained by assuming locally uniform and independent prior distributions of the parameters. Significance tests based on these posterior distributions are used to determine the statistical significance of the observed changes in precipitation which are attributed to the effects of urbanization. The importance of model validation tests and their relationship to the inference are demonstrated by considering the IMA models of different orders. (Wiersma-Indiana)
W80-05331

NORTON SOUND/CHUKCHI SEA OCEANOGRAPHIC PROCESSES (N-COP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05355

2C. Snow, Ice, and Frost

RECONNAISSANCE SNOW SURVEYS OF THE NATIONAL PETROLEUM RESERVE IN ALASKA, APRIL 1977 AND APRIL-MAY 1978,
Geological Survey, Anchorage, AK. Water Resources Div.
C. Sloan, D. Trabant, and W. Glude.
Available from: OFSS, Box 25425, Fed Ctr, Denver CO 80225. Price codes: $5.25 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1342 (WRI), 1979. 31 p, 15 Fig, 3 Tab, 3 Ref.

Descriptors: *Snow surveys, *Evaluation, *Alaska, *Snow management, Sampling, Snowfall, Snow cover, Water equivalent, Snowpacks, Temperature, Remote sensing, *National Petroleum Reserve in Alaska.

Reconnaissance snow surveys of the NPRA (National Petroleum Reserve in Alaska) were made in April 1977 and April-May 1978 to ascertain general snow characteristics and distribution patterns. Thirty-nine sites in 1977 and forty-one sites in 1978 were sampled to determine snow depth, density, structure, and snow-soil interface temperature. In addition, snow surface wind indicators were examined over most of NPRA. In April and early May of two consecutive years, the snow cover in NPRA was thin, wind-packed, and virtually continuous. The depth and water equivalent of the snow generally increased with altitude and with distance from the coastal plain. Snow depth on tundra ranged from less than 0.20 m (meters) near the coast to more than 0.90 m in parts of the Brooks Range. Snow density was relatively high in areas where wind slab was developed throughout the snowpack, and lower where there was less wind slab. In 1977, the coastal plain showed the greatest wind slab development and higher densities, averaging 310 kg/cu m (kilograms per cubic meter) on tundra, while the mountains and foothills had less wind slab and lower densities, averaging 270 kg/cu m. In 1978, with more local variation, snow density on the coastal plain averaged 330 kg/cu m on tundra and averaged 310 kg/cu m in the mountains and foothills. Water equivalent of the snowpack in 1977 ranged from less than 0.10 m in the coastal areas to more than 0.25 m in the Brooks Range, and averaged nearly 0.12 m on tundra for the entire area. Water equivalent of the snowpack averaged more than 0.13 m in 1978. Snow-soil interface temperatures in 1977 ranged from about -20C on the coastal plain, where the snowpack was thin and ambient air temperatures were low, to about -5C in the mountains and foothills where the snowpack was thicker and ambient air temperatures higher. (Kosco-USGS)
W80-05294

2D. Evaporation and Transpiration

ENERGY BUDGET AND MONTHLY EVAPORATION ESTIMATES FOR LAKE SUPERIOR, 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. Schertzer.
Journal of Great Lakes Research, Vol 4, No 3-4, p 320-330, December 1978. 6 Fig, 3 Tab, 38 Ref.

Descriptors: *Energy budget, *Evaporation, *Lake Superior, *Lake Ontario, Heat, Temperature, Parametric hydrology, Networks, Mass transfer, Boundary layers, *Evaporation estimates, *Thermal energy budget, Heat storage change, Network data, Water budget methods, Reflected global radiation, Long wave radiation, Emissivity.

Thermal energy budget components and monthly evaporation estimates were computed for Lake Superior, 1973. Temperature surveys were available from which monthly heat storage change could be evaluated. Other budget parameters were estimated partly from existing basin meteorological network data and partly from empirical relationships. Monthly evaporation estimates computed as a residual from the energy budget were compared to estimates given by the mass transfer and water budget methods. Agreement with the water budget results was within 1 cm for most months. Correspondence with the mass transfer values was less impressive. Large discrepancies occurred in summer situations when the boundary layer was stable and the mass transfer approach overestimated condensation. The thermal energy budget of Lake Superior was computed by assuming negligible contribution from such processes as heating from chemical and biological processes, heat conduction through the bottom, and transformation of kinetic energy to heat. (Roberts-ISWS)

W80-05282

2E. Streamflow and Runoff

HYDROLOGIC CHARACTERISTICS OF AUSTRALIAN STREAMS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
T. A. McMahon.
Report No 3/1979, (1979). 86 p, 21 Fig, 9 Tab, 37 Ref.

Descriptors: *Streamflow, *Discharge(Water), *Hydrology, *Australia, *Data collections, Analysis, Annual peak discharge, Flow, River flow, Watersheds(Basins), Runoff, Monthly, Annual flood, Variability, Mathematical models, Analytical techniques, Statistical methods, Time series analysis, Annual runoff.

This report compares the Australian scene with other continents. It considers the time series characteristics of both annual volumes and peak annual discharges, and it recommends for each annual volume series the type of stochastic model necessary to reproduce the annual flow characteristics. This report is divided into three main parts--analyses concerned with annual flows, monthly flows, and peak annual discharges. In the analyses, data from 166 annual records and 158 monthly flows were used; 172 station records were used in the peak discharge analyses. More than 90% of the station records are longer than 20 years; those with less data are for stations located in areas where longer records are not available. The important conclusions are: (1) Overall, the Australian streams are far more variable than similar streams in other continents. (2) The effect of catchment area on annual C sub V is ambiguous. (3) No one theoretical distribution can be considered to fit adequately the flow volume data of all streams. (4) Based on six tests, about 75% of the records are considered to be random. (5) For stochastic generation of annual flow volumes, a white noise model is adequate for 76% of streams. (6) Analysis of monthly flows shows that the carryover effect of monthly moisture diminishes to an insignificant level after several months. (7) Average 95% flow duration values exhibit up to two orders of magnitude difference among drainage basins. (8) Mean specific peak discharges were related by a power function to drainage areas. The value of the exponent is -0.44 which fits other Australian estimates but differs from values found in other countries. (9) Average values for drainage divisions of the index of variability of peak annual discharges varied from 0.18 in Tasmania to 0.65 for the arid zone. The median value was 0.46. (10) Approximately 17% of the 133 streams with continuous records showed dependence of peak annual discharges. (Humphreys-ISWS)
W80-05120

THE EFFECT OF DATA INDEPENDENCE IN MODEL CALIBRATION AND MODEL TESTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-05141

A NOTE ON CHANGES IN CHANNEL GEOMETRY AT TRIBUTARY JUNCTIONS,
Hull Univ. (England). Dept. of Geography.
K. S. Richards.
Water Resources Research, Vol 16, No 1, p 241-244, February 1980. 3 Fig, 2 Tab, 19 Ref.

Descriptors: Geomorphology, *Streams, *Channels, *Width, *Model studies, Mathematical models, Rivers, Tributaries, Stochastic processes, Probability, Regression analysis, Drainage, Drainage patterns(Geologic), Hydrology, Hydraulics.

Evidence was presented to justify the assumption that channel width varies stochastically about an approximately constant mean width within a stream link of an alluvial channel. Adjustments of channel width occur predominantly at junctions, but Miller's simple model describing such changes is misleading, and an alternative was proposed whose implication is that channel width (and probably other channel dimensions) is a power function of link magnitude. It was suggested that an alternative to conventional hydraulic geometry is provided by the combination of a step function describing changes at junctions and a stochastic model of variation within individual links. (Sims-ISWS)
W80-05143

COMPOSITE ROUGHNESS OF NATURAL CHANNELS,
Dames and Moore, Bethesda, MD.
A. K. Motayed, and M. Krishnamurthy.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 70-78, 1978. 1 Fig, 1 Tab, 7 Ref, 2 Append.

Descriptors: *Natural streams, *Roughness coefficient, *Mannings equation, *Cross-sections, Roughness(Hydraulic), Channels, Variability, Equations, Analytical techniques, Analysis, Composite roughness, Mannings n.

The purpose of this investigation was to evaluate some of the existing formulas to compute the composite roughness with data from natural stream channels. In this analysis the roughness of subsections was calculated by assuming a logarithmic velocity distribution in each subsection. However, it is not yet fully established that logarithmic velocity distribution is valid during high stages of flows in river channels. In order to evaluate any such formula for composite roughness, it is therefore desirable to have the data necessary to compute the energy gradient in a reach, like water surface slopes and/or velocity contours. It was recommended that more data of natural channels during flood conditions be collected so that a better evaluation of formulas can be made. (See also W80-05159) (Humphreys-ISWS)
W80-05165

HYDRAULICS OF FLOW IN THE KASKASKIA RIVER,
Illinois State Water Survey, Urbana.
N. G. Bhowmik, and J. B. Stall.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 79-86, 1978. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *River flow, *Flow characteristics, *Illinois, On-site investigations, Hydraulics, Flow, Velocity, Distribution patterns, On-site data collections, Analysis, Discharge(Water), Head loss, Roughness coefficient, *Kaskaskia River(IL), Isovels.

Hydraulics of flow were investigated at two reaches in the Kaskaskia River for low, medium, and bankful discharges. Analysis of cross-sectional shapes indicates that a trapezoidal shape can be used for straight reaches and a parabolic shape for the bends. In the bends, the maximum depths, up to 100% greater than the average depth, were located at a distance of about 25% of the width from the outside bank. The core of the high velocity remained near the center of the cross-section in the straight reaches for all flows. However, in the bend a shifting was observed. The nature of this shifting indicated the presence of a stronger secondary circulation at medium flow. The strength of the secondary circulation decreased when the discharge increased toward the bankful stages. The secondary circulation in the bends modified the velocity structure making the differential between the average velocity and the maximum-point velocities to be smaller than those present in the straight reaches. The total head loss over the whole length of the river decreased as the discharge increased. The unit discharge at various verticals was found to be proportional to the respective depths. (See also W80-05159) (Humphreys-ISWS)
W80-05166

AN ANALYSIS OF TOTAL PHOSPHORUS TRANSPORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5B.
W80-05171

INTRODUCTION TO NUMERICAL METHODS,
Texas A and M Univ., College Station.
D. R. Basco.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 280-302, 1978. 16 Fig, 5 Ref.

Descriptors: *Mathematical models, *Hydraulics, *Streamflow, Model studies, Equations, Mathematics, Mathematical studies, Numerical analysis, Analytical techniques, Evaluation, Numerical methods.

Superficially, the finite-difference method is deceptively simple. Past emphasis on stability criteria and not on numerical accuracy has lulled the hydraulic engineer into believing that numbers generated by a 'calibrated' model are correct. Mathematically, an accuracy analysis is relatively complex. However, a recipe can be written for any scheme so that accuracy portraits (both amplitude and phase) can be easily computed. Although not exact, these portraits give insight into the proper grid and time spacings to employ, whether implicit schemes are worthwhile, and other factors to insure a desired accuracy in the computations. For simulation and modeling applications, these concepts will permit more physically realistic calibration and verification phases of the prototype. For computer-based research, these ideas must be understood to insure that the 'data' generated numerically is as accurate as that measured by instruments in physical experiments. (See also W80-01519) (Sims-ISWS)
W80-05184

EXAMPLES OF PROPAGATION PROBLEMS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
M. Amein.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 343-349, 1978. 4 Fig, 6 Ref.

Descriptors: *River flow, *Storm surge, *Model studies, Mathematical models, Computer models, Flow, Discharge(Water), Water levels, Hydrographs, Rivers, Bays, Hydraulics, Hydrology, Hydraulic propagation.

There are a number of practical propagation problems of concern to practicing engineers that can be correctly solved only by mathematical models requiring computers. Analytical solutions are not feasible, and hand-calculations would be time consuming. Among these are flood movements in rivers, dispersion of pollutants in estuaries and coastal waters, and computation of storm surge along the shores. Examples of propagation problems were presented. (See also W80-05159) (Sims-ISWS)
W80-05189

WATER QUALITY MODELING USING HYDROCOMP SIMULATION PROGRAMMING (HSP),
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W80-05191

NWS OPERATIONAL DYNAMIC WAVE MODEL,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
D. L. Fread.

In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 455-464, 1978. 2 Fig.

Descriptors: *River forecasting, *Flood forecasting, *Mathematical models, Rivers, Floods, Water levels, Storage, Roughness(Hydraulic), Inflow, Dams, Locks, Hydrology, Dynamic wave models.

An operational hydrodynamic model (DWOPER) developed by the Hydrologic Research Laboratory of the National Weather Service is being placed in operational use by River Forecast Centers on a number of major river systems where storage routing methods are inadequate due to the effects of backwater, tides, and mild channel bottom slopes. The model is based on the complete one-dimensional St. Venant equations and belongs to the category of dynamic wave flood routing models. A weighted four-point nonlinear implicit finite difference scheme is used to obtain solutions to the St. Venant equations via a Newton-Raphson iterative technique. DWOPER has a number of features which make it applicable to a variety of natural river systems for real-time forecasting. It is designed to accommodate various boundary conditions and irregular cross-sections located at unequal distances along a single multiple-reach river or several such rivers having a dendritic configuration. It allows for roughness parameters to vary with location and stage or discharge. Temporally varying lateral inflows, wind effects, bridge effects, off-channel storage, and weir-flow channel bifurcations are included among its features. Applications of DWOPER to several large river systems have demonstrated its operational efficiency, accuracy, and utility. The model is currently being extended to account for effects of channel sinuosity, flood plains, sediment transport, and bank storage on unsteady flows in alluvial rivers. (See also W80-05159) (Sims-ISWS)
W80-05198

EFFECTS OF EQUATION AVERAGING ON MODEL VERIFICATION,

South Carolina Univ., Columbia. Dept. of Civil Engineering.
B. A. Benedict.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 483-491, 1978. 1 Tab, 17 Ref. USAF F08635-77-C-0237.

Descriptors: *Flow, *Diffusion, *Water quality, *Mathematical models, *Equations, Analytical techniques, Mathematics, Calibrations, Velocity, Streamflow, Hydrology, Pollutants, Path of pollutants, Equation averaging.

The concern over water quality has led to an increasing need for techniques to predict the behavior (movement, diffusion, and the like) of releases to a receiving water body. Analytical solutions to the diffusion equation are frequently used for these predictions. The basic equation of interest is the three-dimensional convective diffusion equation subjected to no-flux conditions at the air-water interface and at lateral and bottom boundaries. In arriving at a solution, one or more properties is averaged over one or more dimensions (including time) to obtain a tractable equation form. This paper was concerned with the important need to account for effects of these averaging processes when using data to verify these models. (See also W80-05159) (Sims-ISWS)
W80-05200

PREDICTION OF RIVER STAGES,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R-M. Li, G. O. Brown, and D. B. Simons.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 541-550, 1978. 6 Fig, 1 Tab, 1 Ref, 2 Append.

Descriptors: *Water levels, *Rivers, *Forecasting, *Model studies, *Mississippi, Mathematical models, Stage-discharge relations, Discharge(Water), Calibrations, On-site investigations, Alluvial channels, *Yazoo River(MS).

Accurate prediction of the river stage for a given discharge is one of the most important problems in fluvial hydraulics. Prediction of stage discharge is necessary for analysis of flood-damage mitigation, sediment transport, navigation, and water quality. River stage can be predicted either by statistical stage-discharge relationships or by using deterministic physical process models. Presently, there are no guidelines regarding the application of these two approaches. The purpose of this paper was to examine the frequency and magnitude of error associated with each model by applying each method to two case studies. One case involves a relatively stable reach of river, while the other is unstable. Both models are relatively accurate for the stable reach. However, the mathematical model that considers the physical processes of open channel flow and fluvial geomorphology is the only feasible approach to predict the response of an active river. In addition, a probabilistic prediction of the river stage by coupling the deterministic model with a stochastic discharge input was demonstrated. (See also W80-05159) (Humphreys-ISWS)
W80-05206

TAXONOMY OF SOLUTIONS: UNSTEADY OPEN CHANNEL FLOW,

Soil Conservation Service, Glenn Dale, MD. Engineering Div.
F. D. Theurer.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 591-598, 1978.

Descriptors: *Open channel flow, *Unsteady flow, *Analytical techniques, *Systematics, Mathematical models, Analysis, Algorithms, Classification, Methodology.

A taxonomy of solutions for unsteady open channel flow problems was offered which, hopefully, will lead to a comprehensive classification system and ultimately to a quantitative basis for evaluating various solutions. A valid taxonomic approach would bring order to a classification system in an orderly, not arbitrary, manner. This is done by addressing three basic questions to each specific solution scheme: (1) how good will the answer be, (2) how can the answer be obtained, and (3) how much is it going to cost. These three questions lead directly to the major areas of differentiation: (1) the math model, (2) the method of solution, and (3) the technique of computation. The math model is the analytic representation. The method of solution and technique of computations are distinct parts of methodology. The development of an unsteady open channel flow computer model for large scale field use is needed. Future studies will require: (1) the classification and selection of the important solutions to minimize the study effort, (2) the development of a means to relate the hydraulic and hydrologic properties of channel system and hydrographs to the responses so that the results can be reliably generalized for field applications, (3) the selection of the scope of the study to reflect field situations, (4) the development of a single comprehensive computer analysis model to minimize differences between programmers, (5) the execution and interpretation of test data to develop logical dependable data-directed techniques for an operational computer program, and (6) the development of an operational, comprehensive, data-directed, user-oriented, efficient, accurate, reliable, and optimized computer model for unsteady open channel flow problems. (See also W80-05159) (Humphreys-ISWS)
W80-05212

SUBCRITICAL KINEMATIC STREAMFLOW,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.
D. E. Overton, and J. Bales.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 599-604, 1978. 5 Ref.

Descriptors: *Streamflow, *Subcritical flow, *Mathematical models, *Flood waves, Analytical techniques, Analysis, Equations, Discharge(Water), Open channel flow, Flood routing, Model studies, Kinematic flow equations.

Prediction of the behavior of a flood wave in a natural channel is essential in the design of channel improvements and flood control measures. The kinematic flow approximation has proven to be a very useful simplification in the determination of the movement of a flood wave down a channel and the prediction of any related changes in form or height of the wave. Integration of the momentum equation for kinematic flow in a wide rectangular channel for the cases of $b = 2.0$, $b = 2.5$, and $b = 3.0$ yields solutions for downstream flow depth at a given distance downstream, for a given set of physical conditions, and at a given point in time. Lateral inflow is independent of flow depth for the case of $b = 2.0$, and thus may be input into the solution as a step function. Momentum added by the lateral inflow was assumed to be negligible for the cases of $b = 2.5$ and $b = 3.0$. Thus a method of routing a flood wave through a natural channel under kinematic flow conditions was proposed. The only input required for the solution is the known physical information about the reach--the bed slope, Chezy C, width of the channel, and a single-valued rating curve--and the inflow hydrograph to the reach. This method of solution is also in the process of being made even more general by the numerical integration of the momentum equation. These solutions will have the added advantage of being applicable to any b value and may be used to verify the closed form analytical solutions of this study. (See also W80-05159) (Humphreys-ISWS)
W80-05213

APPLICABILITY OF KINEMATIC AND DIFFUSION MODELS,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, R-M. Li, and D. B. Simons.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 605-613, 1978. 4 Fig, 1 Tab, 5 Ref, 3 Append.

Descriptors: *Mathematical models, *Open channel flow, *Flood waves, *Celerity, Model studies, Diffusion, Overland flow, Waves(Water), Analytical techniques, Analysis, Flood routing, Kinematic wave model.

The applicability of the kinematic and diffusion models was assessed by comparing the propagation characteristics of sinusoidal perturbations to the steady uniform flow for the kinematic, diffusion, and dynamic models (the dynamic model is that based on the complete Saint Venant equations). The comparison allows the determination of inequality criteria that need to be satisfied if the kinematic or diffusion models are to simulate the physical phenomena within a prescribed accuracy. It was shown that bed slope and wave period (akin to wave duration in waves of shape other than sinusoidal) are the important physical characteristics in determining the applicability of the approximate models. Larger bed slopes or long wave periods will satisfy the inequality criteria. In practice, larger bed slopes are those of overland flow, and long wave periods are those corresponding to slow-rising flood waves. The diffusion model was shown to be applicable for a wider range of bed slopes and wave periods than the kinematic model. Where the two models break down, only the dynamic model will simulate the physical phenomena. The dynamic wave, however, was shown to have markedly strong dissipative tendencies. This conclusion has had ample corroboration in the literature. (See also W80-05159) (Humphreys-ISWS)

W80-05214

THE NUMERICAL DISPERSION OF THE MUSKINGUM METHOD,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, V. Yevjevich, and D. B. Simons.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 614-620, 1978. 2 Fig, 4 Ref, 2 Append.

Descriptors: *Flood routing, *Mathematical models, *Analytical techniques, Analysis, Dispersion, Numerical analysis, Equations, Mathematical studies, Kinematic wave equation.

It was the objective of this paper to further explore the nature of the numerical dispersion underlying the formulation of the Muskingum method. The findings reported should contribute to the increased understanding of the method and thus enhance its use and applicability for a wide range of flood routing problems. The analogy between the Muskingum formulation and the diffusion wave equation was demonstrated; both have the same limits of applicability. The applicability of the diffusion wave model has been established by Ponce and others on theoretical grounds. The numerical dispersion underlying the formulation of the Muskingum method was critically reviewed. A sensitivity analysis shows the calculated Muskingum discharge to be a bounded function of the Courant number and the cell Reynolds number. (See also W80-05159) (Humphreys-ISWS)
W80-05215

THE STOCHASTIC VARIATION OF IN-STREAM VALUES IN RIVERS,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 5C.
W80-05217

ANALYSIS OF SUB- AND SUPERCRITICAL DAM-BREAK FLOWS,
Michigan State Univ., East Lansing. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-05223

APPLICATION OF COSSARR MODEL IN CENTRAL JAVA,
Engineering Consultants, Inc., Denver, CO.
For primary bibliographic entry see Field 2A.
W80-05226

CONTROL OF UNSTEADY FREE-SURFACE FLOW WITH GATES,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
E. B. Wylie, and W. E. Bodley.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 767-774, 1978. 7 Fig, 6 Ref.

Descriptors: *Open channel flow, *Flow control, *Gates, Unsteady flow, Analytical techniques, Analysis, Reservoirs, Discharge(Water), Flow, Depth, Movement, Gate stroking.

The purpose of this paper was to show how the concept can be applied to a series of any number of pools separated by control gates. The application was illustrated for a series of three pools, separated by underflow gates, the series also originating and terminating in underflow gates, both with reservoir conditions on the other side. Channel dimensions and other properties were chosen to be representative of the California Aqueduct, for which empirical methods of control have been presented by Dewey and Madsen. Two typical demand changes were studied--flow initiation (0 to 3,520 cfs in 78 min), and flow arrest (6,000 cfs to 0 in 84.5 min). In each case, a linear change between the initial and the final demands was prescribed. The volume of water in each pool was maintained approximately constant throughout each demand change. The required motions of all control gates were determined, together with the transient water level variations that result from the imposed patterns of demand change. The results of all 'gate-stroking' calculations were confirmed by 'analysis.' (See also W77-10891 and W80-05159) (Humphreys-ISWS)
W80-05232

THE EFFECT OF PRECIPITATION PATTERNS ON SURFACE RUNOFF,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 2A.
W80-05233

LINEARIZED SUBHYDROGRAPHS URBAN RUNOFF MODEL,
Akron Univ., OH. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-05234

WATER QUALITY MODELING IN THE UPPER REACHES OF THE CHOWAN RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05253

DISSOLVED OXYGEN IN INTRAGRAVEL WATER OF THREE TRIBUTARIES TO REDWOOD CREEK, HUMBOLDT COUNTY, CALIFORNIA,
Geological Survey, Helena, MT.
For primary bibliographic entry see Field 5B.
W80-05259

USING ARTIFICIAL STREAMS TO EVALUATE PERTURBATION EFFECTS ON AUFWUCHS STRUCTURE AND FUNCTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W80-05260

WATER QUALITY PROJECTIONS: PREIMPOUNDMENT CASE STUDY,
Maryland Univ., College Park, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05263

FLOOD HAZARD IDENTIFICATION AND FLOOD PLAIN MANAGEMENT ON ALLUVIAL FANS,
Army Engineer Div. North Pacific, Portland, OR.
L. M. Magura, and D. E. Wood.
Water Resources Bulletin, Vol 16, No 1, p 56-62, February 1980. 8 Fig, 6 Ref.

Descriptors: *Alluvial fans, *Flood plain insurance, *Southwest U.S., Management, Floods, Flood damage, Flood frequency, Flood waves, Flood flow, Erosion, Sediments, Design flood, Historic floods, Flash floods, Insurance, Hazards.

Recognition of the flood hazard that exists on alluvial fans has seriously lagged behind the recognition of other more conventional flood hazards such as those associated with most rivers. This delay in recognition was due, until recently, to a general lack of economic investment and development in these areas and a concomitant lack of historical alluvial fan flood damage. Dramatic recent events, such as Tropical Storm Kathleen, emphasized to the Federal Insurance Administration (FIA) the need for developing an appropriate methodology to identify flood hazard areas on alluvial fans. This paper presents the methodology now employed by FIA as well as flood plain management considerations that could reduce future flood related damage to communities developing in these areas. (Sims-ISWS)
W80-05264

REGIONAL STOCHASTIC GENERATION OF STREAMFLOWS USING AN ARIMA (1,0,1) PROCESS AND DISAGGREGATION,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. T. Armbruster.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 945, Price codes: A04 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 79-3, May 1979. 54 p, 26 Fig, 16 Tab, 24 Ref.

Descriptors: *Stochastic processes, *Streamflow, *Model studies, *Statistical models, *Flow characteristics, High flow, Low-flow, Natural flow, Correlation analysis, Frequency analysis, Regional analysis, Synthetic hydrology, Time series analysis, Pennsylvania, *Juniata River basin(Pa), *Autoregressive Integrated Moving Average(ARIMA), Dissaggregation.

An ARIMA (1,0,1) model was calibrated and used to generate long annual flow sequences at three sites in the Juniata River basin, Pennsylvania. The model preserves the mean, variance, and cross correlations of the observed station data. In addition, it has a desirable blend of both high and low frequency characteristics and therefore is capable of preserving the Hurst coefficient, h. The generated annual flows are disaggregated into monthly sequences using a modification of the Valencia-Schaake model. The low-flow frequency and flow duration characteristics of the generated monthly flows, with length equal to the historical data, compare favorably with the historical data. Once the models were verified, 100-year sequences were generated and analyzed for their low flow characteristics. One-, three- and six- month low-flow frequencies at recurrence intervals greater than 10 years are generally found to be lower than flow computed from the historical flows. A method is proposed for synthesizing flows at ungaged sites. (Kosco-USGS)
W80-05291

HYDROLOGICAL FEATURES OF A CALIFORNIA COASTAL FEN,
California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 2H.
W80-05310

TRANSPLANTING AQUATIC BRYOPHYTES TO ASSESS RIVER POLLUTION,
University Coll., Cardiff (Wales). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W80-05311

2F. Groundwater

COMPUTATIONALLY EFFICIENT POLYNOMIAL APPROXIMATIONS USED TO PROGRAM THE THEIS EQUATION,
Wyoming Univ., Laramie. Dept. of Geology; and Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 6A.
W80-05121

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING AND INJECTION WELLS: II--CONSTANT PUMPING (INJECTION) RATE, SINGLE FULLY PENETRATING WELL, SEMICONFINED AQUIFER,
Missouri Univ. Rolla. Dept. of Geological Engineering.
For primary bibliographic entry see Field 6A.
W80-05122

GROUND-WATER MODELING: AN OVERVIEW,
GeoTrans, Corp., Reston, VA.
J. W. Mercer, and C. R. Faust.
Ground Water, Vol 18, No 2, p 108-115, March-April 1980. 4 Fig, 1 Tab, 8 Ref. EPA R-803713.

Descriptors: *Groundwater, *Aquifers, *Model studies, *Reviews, Mathematical models, Comput-

er models, Hydraulic models, Groundwater movement, Path of pollutants, Wells, Water wells, Pumping, Hydrology, Model usage, Modeling concepts.

Groundwater modeling is a tool that can help analyze many groundwater problems. Models are useful for reconnaissance studies preceding field investigations, for interpretive studies following the field program, and for predictive studies to estimate future field behavior. In addition to these applications, models are useful for studying various types of flow behavior by examining hypothetical aquifer problems. Before attempting such studies, however, one must be familiar with groundwater modeling concepts, model usage, and modeling limitations. (Sims-ISWS)
W80-05123

INFLUENCE OF REGOLITH PROPERTIES ON MIGRATION OF SEPTIC TANK EFFLUENT,
University of South Florida, Tampa. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W80-05124

DETERMINATION OF AQUIFER PARAMETERS FROM STEP TESTS AND INTERMITTENT PUMPING DATA,
Summers (W.K.) and Associates, Socorro, NM.
Y. K. Birsoy, and W. K. Summers.
Ground Water, Vol 18, No 2, p 137-146, March-April 1980. 13 Fig, 2 Tab, 7 Ref, 1 Append.

Descriptors: *Drawdown, *Pumping, *Theis equation, *Model studies, Mathematical models, Equations, Transmissivity, Storage, Recharge, Wells, Water wells, Groundwater, Groundwater movement, Aquifers, Test wells, Hydrology, Hydraulics, Hand calculator programs.

This note presented a technique used to evaluate drawdown and recovery data obtained during step-pumping tests or during several episodes of intermittent pumping. First, the simple general equation was presented that relates the usual variables (drawdown, transmissivity, storativity, etc.) to step-wise changes in discharge. (Intermittent pumping equates to a step with zero discharge.) Then it was shown how the equation provides a basis for determining transmissivity and storativity of the water-yielding rocks using nearly all the data simultaneously. Next it was discussed how departures of the data during conventional step-drawdown tests from the ideal provide other useful hydrogeologic information. Finally some examples were given from field experience. (Sims-ISWS)
W80-05125

APPROXIMATION FOR SALT-WATER INTRUSION IN UNCONFINED COASTAL AQUIFER,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
For primary bibliographic entry see Field 2L.
W80-05126

AQUIFER OCCURRENCE IN THE FORT PAYNE FORMATION,
Oak Ridge National Lab., TN. Environmental Sciences Div.
M. S. Moran.
Ground Water, Vol 18, No 2, p 152-158, March-April 1980. 3 Fig, 2 Tab, 13 Ref. USGS 4061-02808.

Descriptors: *Aquifers, *Hydrogeology, *Water quality, *Groundwater, On-site investigations, Rocks, Geology, Geologic units, Chert, Sands, Gravels, Test wells, Sampling, Water chemistry, Chemicals, Petrology, Stratigraphy, Weathering, Fort Payne Formation.

The Fort Payne Formation of Early Mississippian (Osagean) age crops out over extensive areas of central Tennessee, south-central Kentucky, and northern Alabama. Specific formation lithologies are knwon to have been modified locally through weathering into an artesian aquifer along the Eastern Highland Rim of central Tennessee. The shallow aquifer can be divided into two parts; uppermost is a highly permeable chert gravel zone that is in hydraulic communication with a lower zone of interconnected solution cavities within bedrock. The gravel, at depths as great as 24.4 m (80 ft), fines upward into the clay-sized chert of the upper confining bed. The lower confining bed is the Chattanooga Shale of Late Devonian to Early Mississippian age. Field and petrographic studies of the Fort Payne Formation indicate that the aquifer has developed near the base of the unit. The chert gravel portion of the aquifer has developed from silicified dolowacke-stones of the Beaver Creek Limestone Member and from interbedded Fort Payne dolostones. The lower portion of the aquifer occurs within preferentially weathered, silicified and nonsilicified dolosiltstone. (Sims-ISWS)
W80-05127

A COMPARATIVE STUDY OF NITRATE LEVELS AT THREE ADJACENT GROUNDWATER SOURCES IN A CHALK CATCHMENT AREA WEST OF LONDON,
Thames Water Authority, Reading (England). Thames Conservancy Div.
E. M. Gray, and M. Morgan-Jones.
Ground Water, Vol 18, No 2, p 159-167, March-April 1980. 6 Fig, 3 Tab, 21 Ref.

Descriptors: *Groundwater, *Nitrates, *Hydrogeology, *Water chemistry, Boreholes, Borehole geophysics, On-site investigations, Water wells, Observation wells, Geology, Recharge, Infiltration, Chemicals, Pollutants, Path of pollutants, Fertilizers, Nutrients, Water resources, Water sources, *England.

A comparison of the concentrations of nitrate in three public supply borehole sources, which abstract water from the Chalk in a relatively local area, lead to a more detailed study of the possible causes of high nitrate values at one of the sources and the geological and recharge characteristics of all three. The local catchment area of the high nitrate source is actively fertilized, both by sludge spreading and the application of artificial fertilizers. The catchment areas of the other two groundwater sources are not subject to the same intensive agricultural activity. It was suggested that the differences in water quality between the three supplies are related to the variations in land use and the local hydrogeology. The study made it clear that due to local influences each source may have a unique hydrogeochemical character irrespective of being located in the same regional geological catchment area. More detailed investigations on the origins of the nitrate in the abstracted groundwaters are planned as a follow-up to this initial study. (Sims-ISWS)
W80-05128

AN EVALUATION OF ILLINOIS LAWS AND REGULATIONS RELATED TO THE QUALITY OF GROUND WATER.
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 6E.
W80-05154

PERTURBATION SOLUTIONS FOR WATER-TABLE AQUIFERS,
Geological Survey, Tacoma, WA.
E. A. Prych.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY-4, p 603-608, April, 1980. 3 Fig, 3 Ref.

Descriptors: *Perturbation method, *Unsteady flow, *Ground water movement, *Water table aquifers, Equations, Numerical analysis, Transmissivity, Approximation method.

This paper describes a linearization procedure, based on a perturbation method, which can be used for solving the unsteady equation of motion for two-dimensional ground water flow in a water-table aquifer. This method retains the computationally efficient aspects of the method of specified transmissivities, yet partially accounts for the effect of the time-varying saturated thickness on the transmissivity. Consequently, numerical solutions of the perturbation equations can be more accurate than solutions of the equation with specified transmissivities. The only significant additional computation required with the perturbation method is the solution of one nonlinear steady-state problem. (Purdin-NWWA)
W80-05158

CALIBRATION OF THE EDWARDS AQUIFER MODEL,
Texas Dept. of Water Resources, Austin.
T. Knowles, and W. B. Klemt.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 94-100, 1978. 1 Fig.

Descriptors: *Model studies, *Aquifers, *Texas, *Groundwater, Aquifer management, Planning, Calibrations, Springs, Recharge, Computer models, Aquifer characteristics, Water levels, *Edwards Aquifer(TX).

The Edwards Aquifer Model was developed to determine the dependability of the Edwards (Balcones Fault Zone) aquifer as a water supply for the San Antonio, Texas, area. The model was developed to be a groundwater planning tool which would allow evaluation of the impacts of future pumpage on the aquifer. The model allows input of various sequences of recharge and pumpage and determines the resulting water levels and spring flows. The calibration procedure involved the adjusting of the initial estimates of the model's parameters until sufficiently accurate reproduction of water levels and spring flows were achieved. The period of record used in the calibration extended from 1947 through 1971. Most of the adjustments made during the calibration phase of the model development involved changing permeability values. This was due in large part to the confidence in the other values. The Edwards model has been used to evaluate several alternative development plans. Its results have been used in several studies, and it has proven to be an effective planning tool. The acceptance of the results provided by the model is due in large part to the effort applied in developing the data used during the calibration phase of its development. (See also W80-05159) (Humphreys-ISWS)
W80-05167

STEADY STATE VS. TRANSIENT PARAMETER ESTIMATION IN GROUNDWATER SYSTEMS,
Massachusetts Inst. of Tech., Cambridge.
J. L. Wilson, and M. Dettinger.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 112-119, 1978. 6 Ref, 1 Append. AID-NE-C-1291, OSP 85054.

Descriptors: *Aquifer systems, *Groundwater, *Model studies, Steady flow, Mathematical models, Analytical techniques, Analysis, Mathematical studies, Unsteady flow, Groundwater movement, Equations, Deterministic model, Parameter estimation.

The objective of this paper was to contrast the information content of field data from static observations to observations made during different levels of transient aquifer response. Linear predictive aquifer models based on First Order Analysis, accounting for system state and parametric uncertainty, were used in conjunction with the Kalman-Bucy Filter to predict future aquifer behavior and to obtain sequential parameter estimates. A simplification of these models was used for the estimation of parameters for steady state conditions. The analysis results demonstrated that static or slowly responding systems are relatively insensitive to the values of parameters, and consequently the parameters are difficult to estimate. For more rapidly responding and highly stressed systems the param-

eter sensitivity and the information content of measurements is significantly increased. (See also W80-05159) (Humphreys-ISWS)
W80-05168

GROUNDWATER SIMULATION FOR KOEBERG POWER STATION,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 2L.
W80-05174

A HYBRID COMPUTER SYSTEM FOR GROUNDWATER MODELING,
South Florida Water Management District, West Palm Beach.
G. Shih, and F. McVeigh.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 206-213, 1978. 2 Fig, 4 Ref.

Descriptors: *Groundwater, *Water management(Applied), *Analog models, Aquifers, Model studies, Hybrid computers, Resistance networks, Water utilization, Rainfall, Water wells, Canals, Instrumentation, Evapotranspiration, Calibrations, Hybrid models.

In this paper those aspects of analog simulation related to the South Florida Water Management District (SFWMD) model were discussed. The fluid flow of the aquifer is assumed to be described by the two-dimensional unsteady state equation. The study area was a water table aquifer; however, variations of saturated thickness were small in comparison to the total saturated thickness. The analog simulator was constructed in space-discretized form with a node representing a block area acceptable in space resolution. Since the system gives continuous response in time, the results may be obtained at any time desired. Calibration of the model was accomplished by subjective comparison of the model results and historical water table maps. Both initial condition setup and results after a period of operation are checked for validity. The analog model, with its simplicity in principle, offers a reasonable starting point in cases where there is scarce data. As a specific area simulation tool, the model is used in many different ways, accumulating experiences and knowledge of the aquifer system. At this point, it seems the simplicity in analog approach is becoming a limitation. While the analog model is still in active operation, in preparing for refinement of the Water Use Plan, a digital computer model has already been started. (See also W80-05159) (Humphreys-ISWS)
W80-05175

THE OPTIMIZATION OF PUMPING OPERATIONS IN THE EL SOCORRO AQUIFER BY MATHEMATICAL MODELLING,
National Water Authority of Jamaica (West Indies).
G. S. Shrivastava.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 214-221, 1978. 3 Fig, 1 Tab, 3 Ref, 2 Append.

Descriptors: *Aquifer systems, *Mathematical models, *Water management(Applied), Pumping, Optimization, Hydrogeology, Model studies, Saline water intrusion, Water levels, Groundwater, Aquifer characteristics, Foreign research, Analytical techniques, *Trinidad.

This study began with an investigation of the hydrogeology of the aquifer. The possible sources and mechanisms of intrusion were also examined. A digital simulation model of the aquifer was developed to study the effect of different monthly pumping schedules on the aquifer. During the development of the simulation model it became evident that the salt water intrusion problem had the characteristics of an optimization problem and that the processes of the aquifer were sequential in nature. A simple one-dimensional dynamic programming model was then developed and solved to obtain the desired pumping schedule. The optimum pumping schedule obtained by the application of digital simulation and dynamic programming techniques should prevent further deterioration of water quality and permit the aquifer to remain a significant source of water for the city of Port-of-Spain. The present mathematical models were developed on very limited data, and therefore refinement and extension of the models, as more data becomes available, is expected to considerably improve their effectiveness. (See also W80-05159) (Humphreys-ISWS)
W80-05176

AN EXPERIMENTAL INVESTIGATION OF UPLIFT PRESSURES,
Bechtel Incorp., San Francisco, CA.
For primary bibliographic entry see Field 8A.
W80-05196

A STOCHASTIC-DYNAMIC APPROACH TO THE FOUNDATIONS OF SOLUTE TRANSPORT IN POROUS MEDIA,
Mississippi Univ., University. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05216

A DIGITAL OVERLAY TECHNIQUE FOR EVALUATION OF POTENTIAL INFILTRATION AND RECHARGE,
University of South Florida, Tampa. Coll. of Engineering.
For primary bibliographic entry see Field 4A.
W80-05261

HYDRAULIC PROPERTIES OF A LIMESTONE-DOLOMITE AQUIFER NEAR MARION, NORTH-CENTRAL OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
S. E. Norris.
Ohio Department of Natural Resources Report of Investigations No 110, 1979. 23 p, 22 Fig, 4 Tab, 19 Ref.

Descriptors: *Hydraulic properties, *Limestones, *Aquifers, *Ohio, *Hydrogeology, Aquifer characteristics, Transmissivity, Water wells, Water yield, Pumping, Drawdown, Natural recharge, Leakage, Water supply, Waterfowl, *North-central Ohio, *Big Island Wildlife Area(Ohio).

Tests of a limestone-dolomite aquifer overlain by till at a site near Marion in north-central Ohio indicate strong aquifer heterogeneity, with hydraulic conductivity varying both laterally and vertically. The most conductive part of the aquifer is a 70-foot-thick section between depths of 80 and 150 feet, characterized by fissures and cavities. Transmissivity in the immediate vicinity of the pumped well is in the magnitude of 47,000 cu ft/d, falling to about 2,800 cu ft/d in the outer part of the cone of depression. An integrated value for transmissivity, determined from time-drawdown data by the straight-line semilogarithmic method, averaged about 3,600 cu ft/d; the coefficient of storage averaged about 10 to the minus 4th power. The effect of recharge by leakage from the glacial till was evident on the semilog graphs of time versus drawdown after 4,000 to 6,000 minutes of pumping. The hydraulic conductivity of the glacial till, based on an average regional saturated thickness of 35 feet, is the range of 1.0 x 10 to the minus 4th power to 3.4 x 10 to the minus 4th power feet per day. It is estimated that about half the quantity of 3,000 gal/min of ground water desired for a wildfowl preserve could be obtained from three existing production wells, but such withdrawal would be accompanied by significant drawdown over a wide area that might adversely effect the water supplies of many residents. (Kosco-USGS)
W80-05306

2G. Water In Soils

ANALYSIS OF BOREHOLE INFILTRATION TESTS ABOVE THE WATER TABLE,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. B. Stephens, and S. P. Neuman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-188345, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona Project Completion Report, March 1980. 216 p, 104 Fig, 4 Tab, 55 Ref, 7 Append. OWRT A-076-ARIZ(1).

Descriptors: *Infiltration, *Boreholes, *Model studies, Hydraulic models, Mathematical models, Soil water movement, Subsurface flow, Unsaturated flow, Water table, Finite element analysis, Hydraulics, Specific head, Soil mechanics, Flow characteristics.

Numerical models were used for a saturated-unsaturated analysis of the formulas used in analyzing results from constant head borehole infiltration tests of saturated hydraulic conductivities of unsaturated soils above the water table. A finite element model capable of solving free surface problems shows that in the case where unsaturated flow is not present, the formulas are reasonably accurate for a practical range of borehole conditions. Two different numerical models, a mixed explicit-implicit finite element model and a mixed explicit-implicit integrated finite difference model are used to simulate the effect of unsaturated flow on borehole infiltration under conditions approximating field conditions. While the models give approximately the same results, the integrated finite difference model is faster. Modeling results show that the classical free surface approach used to analyze infiltration results gives a distorted flow pattern for water in the soil. A significant percentage of the flow occurs under unsaturated conditions and only a finite region in the immediate area of the borehole is saturated. An improved design for borehole infiltration tests was developed along with more accurate interpretation methods. (Seigler-IPA)
W80-05108

REGULATION OF SULFATE CONCENTRATIONS AND METHANOGENESIS IN SALT MARSH SOILS,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2L.
W80-05134

A SIMPLE NUMERICAL SOLUTION FOR THE VERTICAL FLOW EQUATION OF WATER THROUGH UNSATURATED SOILS,
Technische Univ., Hanover (Germany, F.R.). Inst. fuer Bodenkunde.
J. Richter.
Soil Science, Vol 129, No 3, p 138-144, March 1980. 10 Fig, 1 Tab, 7 Ref.

Descriptors: *Soil water movement, *Numerical analysis, *Unsaturated flow, *Mathematical models, Percolation, Equations, Soil water, Soils, Computer programs, Hydraulic conductivity, Darcys law, Exponential function.

A simple numerical method to solve the vertical flow equation of water through unsaturated soils is presented. The method is based on the approximation K = K sub O X e to the alpha(psi) power and can be used for any range of soil moisture. The method uses the behavior of the exponential function in an integrated flux formula. The resulting numerical scheme is extremely easy to program and runs about as fast on microcomputers as implicit techniques do on large computers. Mass conservation is also excellent. (Visocky-ISWS)
W80-05135

AN APPLICATION OF BRUTSAERT'S AND OPTIMIZATION TECHNIQUES TO THE NONLINEAR DIFFUSION EQUATION: THE INFLUENCE OF TAILING,
Griffith Univ., Nathan (Australia). School of Aus-

tralian Environmental Studies.
J-Y. Parlange, and R. D. Braddock.
Soil Science, Vol 129, No 3, p 145-149, March 1980. 1 Tab, 11 Ref.

Descriptors: *Diffusion, *Soil water, *Soil water movement, *Model studies, Mathematical models, Equations, Mathematics, Analytical techniques, Optimization, Soil science, Diffusion equations.

A new analytical approximation to the solution of the diffusion equation is so accurate that it will be sufficient for most purposes. In addition, two simple iterations yield a profile that shows the influence of water movement at the initial moisture content. At that stage, the limit to the validity of the diffusion equation is reached, and further iterations are irrelevant. The results were illustrated for an exponential diffusivity. (Sims-ISWS)
W80-05136

COMPARISON BETWEEN MEASURED AND SIMULATED PLANT WATER POTENTIAL DURING SOIL WATER EXTRACTION BY POTTED RYEGRASS,
Louvain Univ. (Belgium). Lab. of Soil Physics.
J. Feyen, C. Belmans, and D. Hillel.
Soil Science, Vol 129, No 3, p 180-185, March 1980. 5 Fig, 23 Ref.

Descriptors: *Soil water, *Soil-water-plant relationships, *Evapotranspiration, *Model studies, Mathematical models, Laboratory tests, Evaporation, Grasses, Leaves, Wilting, Water-requirements, Agriculture, Soil science, Soil water extraction.

A combined simulation-experimentation study was conducted to monitor the simultaneously changing states of plant water and of soil water during a period of continuous transpiration by uniformly rooted ryegrass, grown in pots filled with sandy soil, under two levels of evaporative demand. The pattern of soil moisture extraction was measured by weighing and tensiometry, and that of plant water potential, by leaf psychrometry. A macroscopic-scale extraction model, previously published by the authors, was modified to account for the water-storage characteristics of the crop. Both the original and the modified versions of the model were found able to provide a realistic description of the diurnal fluctuations of plant water potential during the period prior to the onset of plant water stress, but they were less realistic in describing the decline of plant water potential during the dehydration and wilting phases. The rehydration of the crop from a stressed condition could be simulated realistically only by assigning a higher value of root resistance than during the initial extraction phase. (Sims-ISWS)
W80-05138

WATER-MANOMETER TENSIOMETERS INSTALLED AND READ FROM THE LAND SURFACE,
Geological Survey, Syosset, NY. Water Resources Div.
E. T. Oaksford.
Geotechnical Testing Journal, Vol 1, No 4, p 199-201, 1978. 6 Fig. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Descriptors: *Manometers, *Tensiometers, *Instrumentation, *Soil moisture, Measurement, Artificial recharge, Infiltration rates, Recharge ponds, Evaluation, New York, *Long Island(NY), *Water-manometer tensiometers.

Soil-moisture tension has been measured beneath an artificial-recharge basin in Suffolk County, Long Island, N.Y. with water-manometer tensiometers that can be installed and read from the land surface. The manometer-tensiometer unit is buried at the desired depth, and soil-moisture tension is measured from land surface with a simple wire probe and electrical circuit that detect the level of water in the manometer. The water manometer is more sensitive than other common methods for determining unsaturated pressure head or soil-moisture tension over small ranges and is most helpful in situations where small changes in soil-moisture tension can reflect significant changes in hydraulic conductivity. Although the configuration may not be appropriate for installation at great depth (greater than 6 meters) or in extremely coarse or fine soils, it provides rapid, reliable measurement of soil-moisture tension. (Kosco-USGS)
W80-05307

2H. Lakes

LIFE CYCLE, ECOLOGY, AND MANAGEMENT CONSIDERATIONS OF THE GREEN FILAMENTOUS ALGA, PITHOPHORA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W80-05101

AN INTERACTIVE SIMULATION OF PUMPED STORAGE RESERVOIR SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 4A.
W80-05142

INVESTIGATIONS OF SPARGING AS A METHOD FOR PROMOTING COOLING POND HEAT TRANSFER,
Argonne National Lab., IL. Atmospheric Physics Section.
B. B. Hicks.
Journal of Applied Meteorology, Vol 19, No 2, p 193-198, February 1980. 2 Fig, 1 Tab, 6 Ref, 1 Append.

Descriptors: *Heat transfer, *Cooling water, *Lakes, Ponds, Water temperature, Cooling, Thermal stratification, Subsurface investigations, Air-water interfaces, Sprinkling, Heat balance, *Sparging, *Cooling pond, Subsurface, Air bubbles, Aeration rates, Infrared thermometry, Sensible heat.

Destruction of the thin subsurface thermal boundary layer at an air-water interface can be accomplished by relatively low rates of aeration and can result in substantially improved thermal performance when water temperatures are high. The heating and saturating of rising air bubbles can also provide a significant improvement in overall thermal performance when water temperatures and aeration rates are sufficiently great. At 80C, destruction of the subsurface thermal boundary layer allows about 10% more heat transfer without significant increase in water temperature. At 20C, destruction of the subsurface thermal skin results in only a 3% improvement in thermal efficiency. The practical benefits of sparging as a heat transfer improvement mechanism are highest in the case of very hot water bodies associated with emergency cooling systems. (Roberts-ISWS)
W80-05152

FIELD AND MODEL RESULTS FOR MULTIPORT DIFFUSER PLUME,
Tennessee Valley Authority, Norris.
For primary bibliographic entry see Field 5B.
W80-05160

HYDROTHERMAL ANALYSES USING COMPUTER MODELING AND FIELD STUDIES,
Tennessee Valley Authority, Norris.
For primary bibliographic entry see Field 5A.
W80-05161

MEASURING EFFLUENT PLUMES,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W80-05162

A THREE DIMENSIONAL THERMAL PLUME MODEL,
Cooper Union, New York.
For primary bibliographic entry see Field 5A.
W80-05163

TURBID RESERVOIR STRATIFICATION MODELLING,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
S. Dhamotharan, H. G. Stefan, and F. R. Schiebe.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 156-163, 1978. 4 Fig, 2 Ref.

Descriptors: *Reservoirs, *Stratification, *Model studies, *Arkansas, Turbidity, Lakes, Suspended solids, Water temperature, Density stratification, Thermal stratification, Forecasting, On-site investigations, *Lake Chicot(AR).

A study to understand the dynamic characteristics of Lake Chicot, Arkansas, and to formulate a mathematical model to predict the effects of management alternatives on suspended loads is being carried out jointly by the University of Minnesota and the USDA Sedimentation Laboratory. The data taken so far show that the lake is a monomictic lake. In 1976 and 1977 the fall overturn of the lower lake started around the last week of September, after which period the lake stayed well mixed until about the first week of May when stratification started again. The upper lake remained stratified between the last week of May and the first week of September. Lake Chicot, with its shallow depth and large surface area, responds readily to the daily weather conditions. The mathematical simulation of the density stratification of Lake Chicot is therefore based on a method using energy principles and developed by Stefan and Ford. From the simulation results, the period of stratification as a function of weather conditions and heat exchange with the atmosphere was readily apparent, and also the periods of short-term or microstratification. The simulation also provides information on the daily equilibrium temperature which the water attempts to assume. (See also W75-04705 and W80-05159) (Humphreys-ISWS)
W80-05172

MATHEMATICAL THERMAL MODEL FOR PUMPED-STORAGE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
M. S. Dortch.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 492-499, 1978. 3 Fig, 6 Ref.

Descriptors: *Pumped storage, *Reservoirs, *Water temperature, *Model studies, Mathematical models, Hydroelectric power, Powerplants, Pumping, Mixing, Diffusion, Stratification, Temperature, Solar radiation, Lakes.

Kinzua Dam, completed in 1967 and operated by the U.S. Army Engineer District, Pittsburgh, is a pumped-storage hydropower (380 MW capacity) project located on the Allegheny River in northern Pennsylvania. Colder than desired release temperatures have been experienced at Kinzua Dam during the stratification season. A study was initiated during 1977 at the U.S. Army Engineer Waterways Experiment Station to determine the causes of the cooler than expected release temperatures and to evaluate various means of increasing the release temperatures to more closely match natural stream temperatures. A mathematical model is being used in the study to help evaluate corrective measures. This paper dealt with the calibration and verification of this model for pumped-storage operations at Kinzua Dam. The effect of pumped-storage on temperature is to decrease stratification by redistributing heat from the upper layers of the pool to the lower layers. This is evident by the large value of the diffusion coefficient that was required to simulate the temperatures of the bottom layers. The mathematical model, which was developed for computing the thermal budget of pumped-storage reservoirs, has a rather simple approach and provides reasonably good thermal predictions. (See also W80-05159) (Sims-ISWS)
W80-05201

A GRAPHICAL COMPUTATION SYSTEM FOR THREE-DIMENSIONAL LAKE CIRCULATION AND CONTAMINANT DISPERSION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 7C.
W80-05205

AN ELECTRONIC MODEL OF HARBOR WAVES,
Oklahoma Univ., Norman. Dept. of Civil Engineering,
M. M. Sternfeld, L. J. Pratt, and P. L. Monkmeyer.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 574-582, 1978. 6 Fig, 7 Ref.

Descriptors: *Waves(Water), *Harbors, *Analog models, *Model studies, Analytical techniques, Lakes, Theoretical analysis, Mathematical models, Finite element analysis, Instrumentation, *Port Washington(WI).

In an effort to uncover a less expensive and faster alternative to the physical model, an electronic model was described and subjected to preliminary testing in the present investigation. The theoretical background was developed, and the electronic analog was presented. Two separate tests of the model were described: the first simulating a uniform wave train propagating over a sloping bottom, and the second simulating a portion of the harbor of Port Washington, Wisconsin. Experimental and electronic wave envelopes were obtained by simulating a wave of period 1.8 sec. The discrepancy in phase and reflection coefficient between the two envelopes was less than 10%, a result typical of all the runs made. The major dissimilarity between the two profiles was in the variation of wave height over the sloping bottom. The electronic model predicts a decrease in height as shallow water is approached, a result contrary to both theory and experiment. This effect appears to be due to damping in the electronic circuit which seems to become significant when shallow, variable depth regions are being modeled. A resolution of this difficulty remains to be found. It is felt that with further minor modifications and refinements the model may become a relatively inexpensive alternative to the laboratory scale model. (See also W80-05159) (Humphreys-ISWS)
W80-05210

PHOSPHORUS DYNAMICS IN A NORTH CAROLINA PIEDMONT RESERVOIR,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
E. J. Kuenzler, and L. E. Greer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-188691, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina, Raleigh, Report No UNC-WRRI-80-154, January 1980. 65 p, 14 Fig, 14 Tab, 104 Ref. OWRT A-102-NC(2).

Descriptors: *North Carolina, *Phosphorus, *Nutrients, *Nutrient removal, Lake stages, Eutrophication, Water sampling, Suspended solids, Lake sediments, Aquatic algae, Aquatic bacteria, Water temperature, Hypolimnion, Limnology, Epilimnion.

University Lake, a water-supply impoundment in the Piedmont Province of North Carolina, was sampled twice monthly for ten months to determine the patterns of phosphate uptake at different depths throughout the year. The lake is warm-monomictic or dimictic, has an area of 73 ha, a maximum depth of 9m, and an average depth of 3m. The lake is oxygenated at all depths in winter but beginning in March, thermal stratification prevents oxygen transport to the hypolimnion. Samples were taken with a Guzzler hand pump equipped with a plankton net to exclude zooplankton and macroinvertebrates and with a similarly equipped APHA stream sampler. Both chemical analyses and kinetic measurements were made. Filterable reactive phosphate concentrations were low with phosphate being half of the total P in winter but less than a quarter in the other seasons. Inorganic nitrogen concentrations in surface waters were also low. A range of phosphate rate coefficients was found from about 0.06% removal from surface water per minute in January to 40% per minute in June. Algal phosphate uptake was negligible throughout winter but became dominant in June. Results showed bacterial uptake exceeding algal uptake but measurement techniques for these values are questionable. In winter uptake was dominated by suspended sediments. Phosphorus was found to be the most probable major nutrient limiting phytoplankton growth in the lake. (Seigler-IPA)
W80-05244

A FACTOR ANALYSIS OF ELEMENTAL ASSOCIATIONS IN THE SURFACE MICROLAYER OF LAKE MICHIGAN AND ITS FLUVIAL INPUTS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
J. E. Mackin, R. M. Owen, and P. A. Meyers.
Journal of Geophysical Research, Vol 85, No C3, p 1563-1569, March 20, 1980. 5 Fig, 3 Tab, 52 Ref. NSG 04-7-158-44078.

Descriptors: *Lake Michigan, *Geochemistry, *Fluvial sediment, Sediments, Geology, Watersheds(Basins), Limnology, Lakes, Sampling, Statistical methods, Chemical analysis, Surface waters, Surface microlayer, Factor analysis, Sediment chemistry.

Elemental concentrations in surface microlayer and subsurface water samples from Lake Michigan and from its major fluvial sources were subjected to separate R mode factor analyses to define the geochemical phases and mechanisms which influence the composition of the surface microlayer. The associations revealed by these analyses indicate that the composition of fluvial microlayers is controlled by localized factors related to the geology of individual drainage basins, while open lake microlayers are influenced by broad scale physiochemical interactions. Depletions of both dissolved and particulate phase constituents in fluvial microlayers are attributed to upward diffusion of ions in sediment pore fluids and resuspension of bottom sediments. Enrichments of these constituents in open lake microlayers are due to organic complexation, biological uptake, and bubble flotation of fine-grained mineral particles. (Lee-ISWS)
W80-05254

TIME SCALES IN WIND-DRIVEN LAKE CIRCULATIONS,
National Weather Service, Silver Spring, MD. Systems Development Office.
M. A. Mohammed-Zaki.
Journal of Geophysical Research, Vol 85, No C3, p 1553-1562, March 20, 1980. 11 Fig, 14 Ref, 2 Append.

Descriptors: *Lakes, *Circulation, *Lake breezes, Turbulent flow, Eddies, Fluid mechanics, Winds, Limnology, Viscosity, Friction, Mathematical models, Model studies, *Lake circulation, Wind driven circulation, Linearized Ekman equation, Wind stress.

The effect of turbulent friction on transient three-dimensional wind-driven circulation in large lakes was studied. Horizontal friction was neglected, and vertical friction was modeled by a constant eddy viscosity. The linearized Ekman equations were used in a constant depth lake model which was assumed deep (of small Ekman number). High-frequency transients due to acoustic, internal, and surface gravity wave modes were eliminated through assumptions of incompressibility, homogeneity, and rigid lid surface, respectively. The initial value problem arising from a suddenly imposed wind stress on an initially quiescent lake was analytically solved, and significant time scales were identified. It was found that the manner in which transient currents adjust to temporal variations in wind stress depends not only on a lake's physical parameters but also on the wind stress spatial pattern. While the inertial period is always significant, the spin-up time is significant only when the wind stress has a nonzero curl. (Lee-ISWS)
W80-05255

GROWTH INHIBITION OF HYDRILLA VERTICILLATA BY SELECTED LAKE SEDIMENT EXTRACTS,
Southwest Florida Water Management District, Brooksville.
P. M. Dooris, and D. F. Martin.
Water Resources Bulletin, Vol 16, No 1, p 112-117, February 1980. 2 Fig, 1 Tab, 29 Ref.

Descriptors: *Plant growth, *Plant growth regulators, *Sediments, *Lakes, *Florida, Weed control, Aquatic weeds, Aquatic weed control, Inhibitors, Water chemistry, Chemical analysis, Laboratory tests, Biology, Limnology, Growth inhibitors.

Sediments were investigated from two Florida lakes that have not been infested with the submersed, perennial, noxious plant Hydrilla verticillata. Aqueous extracts of the peat-like sediments from these lakes were shown to inhibit the growth of Hydrilla verticillata in laboratory systems. The extracts have substantial concentrations of organic carbon and iron. The apparent molecular weight of the inhibitory fraction is between 2,000 and 10,000, based upon ultrafiltration studies. Hydrilla growth was about 35% relative to control for a partially purified fraction at a level of 0.4 ppm organic carbon. Growth was measured as change in biomass (wet and dry) over a one-week period. The inhibitory material was highly fluorescent, dark brown, and inhibitory activity was lost after passage over an anion-exchange column (Cellex-D). (Sims-ISWS)
W80-05258

WATER QUALITY PROJECTIONS: PREIMPOUNDMENT CASE STUDY,
Maryland Univ., College Park, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05263

LAKE SUPERIOR IN THE 21ST CENTURY,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 6B.
W80-05265

THE FISH COMMUNITY OF LAKE SUPERIOR,
Ontario Ministry of Natural Resources, Maple. Fish and Wildlife Research Branch.
For primary bibliographic entry see Field 5C.
W80-05266

BENTHIC DIVERSITY AND SUBSTRATE-FAUNA ASSOCIATIONS IN LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
R. Dermott.
Journal of Great Lakes Research, Vol 4, No 3-4, p 505-512, December 1978. 3 Fig, 3 Tab, 37 Ref.

Descriptors: *Lake Superior, *Benthos, *Biomass, *Limnology, Sediments, Zinc, On-site investigations, Aquatic life, Invertebrates, Nematodes, Spatial distribution, Oligochaetes, Benthic fauna, Surveys, Lakes, *Whitefish Bay(MI), *Duluth Basin, Diversity weight.

The benthic community of Lake Superior was dominated by Pontoporeia affinis, Stylodrilus heringianus, the Enchytraeidae, and Pisidium conventus. Both total abundance and the low benthic diversity displayed an increase from west to east. The biomass diversity H' weight ranged from 0.29 in the Duluth Basin to 1.22 near Whitefish Bay. Associations between the sediment variables and dominant species present indicated that the effects of depth, percent sand, and mean particle size were prominent. The Sphaeriidae, Chironomini, Pontoporeia, and Rhyacodrilus were negatively associat-

ed with depth, while the Nematoda, Chironomini, and Rhyacodrilus were negatively associated with sand. Stylodrilus and Sphaeriidae were negatively associated with the sediment zinc levels. (Humphreys-ISWS)
W80-05267

PHYTOPLANKTON-ZOOPLANKTON ASSOCIATIONS IN LAKE SUPERIOR: A STATISTICAL APPROACH,
Canada Centre for Inland Waters, Burlington (Ontario).
M. Munawar, and J. B. Wilson.
Journal of Great Lakes Research, Vol 4, No 3-4, p 497-504, December 1978. 1 Fig, 5 Tab, 25 Ref.

Descriptors: *Lake Superior, *Phytoplankton, *Zooplankton, *Limnology, *Data processing, Lakes, Analytical techniques, Analysis, Statistical methods, Sampling, Correlation analysis, Data collections, Crustaceans, Aquatic life, Biomass, Water temperature.

Very little is known about the multiple phytoplankton-zooplankton links in complex food chains. Lake Superior, with a zooplankton population dominated by herbivores, and a phytoplankton community consisting mainly of nannoplankton, is a unique environment for the study of plankton associations. Appropriate statistical techniques, including partial correlations, canonical correlations, and factor analysis, were used to analyze phytoplankton-zooplankton data collected concurrently on Lake Superior during 1973. The multivariate methods revealed more detailed, but less easily interpretable, patterns than did the partial correlations. Over the entire sampling season, canonical correlation and factor analysis produced three significant roots and three multivariate factors, respectively. Temperature was a strong first factor and a root variable during the stratified period. The proposed statistical approaches might serve as powerful tools to explore the apparent relationships between trophic levels. The application of such analyses to comparisons of plankton associations in lakes of varying trophy may prove a useful avenue of research. (Humphreys-ISWS)
W80-05268

CRUSTACEAN ZOOPLANKTON OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
N. H. F. Watson, and J. B. Wilson.
Journal of Great Lakes Research, Vol 4, No 3-4, p 481-496, December 1978. 9 Fig, 3 Tab, 25 Ref.

Descriptors: *Lake Superior, *Zooplankton, *Crustaceans, *Aquatic animals, Lakes, Surveys, Limnology, On-site investigations, Sampling, Copepods, Biomass, Spatial distribution, Data collections, Calanoids.

Six lakewide surveys were carried out on Lake Superior between May and November of 1973. The zooplankton population was found to be dominated by calanoids, and total abundance was generally low in comparison with the lower Great Lakes. Little variation was seen in total numbers/cu m through the sampling season, but total biomass increased fivefold between May and September. The lake appeared to support a permanent year-round lakewide community composed of Diacyclops bicuspidatus thomasi and the larger calanoid species. This community was augmented annually by a succession of summer forms which developed initially inshore and then spread to various degrees into the offshore waters. The zooplankton data were fitted to the fifteen zones defined by previous authors. This procedure showed the zooplankton community to be quite heterogeneous with greatest abundances being found in the inshore zones. Seasonal cycles of both numbers and biomass varied widely, but zone patterns could easily be grouped by general geographic area. The use of zone averages revealed a strong correlation between zooplankton biomass and surface water temperature. Cluster analysis was used to define independently regions of similar species composition. This procedure revealed that the zooplankton community was relatively homogeneous throughout the lake in the spring. Local clusters appeared in many inshore areas during the early summer, and by early fall the zooplankton community distribution was heterogeneous. Homogeneous conditions returned quickly with the late fall turnover. Most of the inshore regions occurred adjacent to areas of probable land-use effects. The life histories of selected major species were examined in cases where sampling and identification procedures permitted their analysis. (Humphreys-ISWS)
W80-05269

STATISTICAL EVALUATION OF THE RELATIONSHIPS BETWEEN PHYTOPLANKTON BIOMASS, CHLOROPHYLL A, AND PRIMARY PRODUCTION IN LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
A. El-Shaarawi, and M. Munawar.
Journal of Great Lakes Research, Vol 4, No 3-4, p 443-455, December 1978. 5 Fig, 9 Tab, 17 Ref.

Descriptors: *Lake Superior, *Phytoplankton, *Chlorophyll, *Primary productivity, Statistical methods, Biomass, Spatial distribution, Temporal distribution, Regression analysis, Data processing, Analytical techniques, Lakes, Limnology.

Phytoplankton biomass, chlorophyll a, and primary production data collected during 1973 from Lake Superior were statistically analyzed using different regression techniques. The pattern of the spatial and temporal variabilities displayed by these parameters was determined. The analysis resulted in dividing the lake into three regions based on phytoplankton biomass and chlorophyll a, whereas two regions were found for primary production. The relationship between the biomass and chlorophyll a was highly significant, but the degree of significance varied by season. The variability in the chlorophyll a concentration was found closely related to the changes in the relative abundance of various taxonomic groups of phytoplankton. (Sims-ISWS)
W80-05270

PHYTOPLANKTON OF LAKE SUPERIOR 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
M. Munawar, and I. F. Munawar.
Journal of Great Lakes Research, Vol 4, No 3-4, p 415-442, December 1978. 18 Fig, 8 Tab, 47 Ref.

Descriptors: *Phytoplankton, *Lake Superior, *Great Lakes, Biomass, Spatial distribution, Temperature, Water temperature, Diatoms, Dinoflagellates, Nannoplankton, Plankton, Aquatic microorganisms, Primary productivity, Nutrients, Lakes, Limnology, Cyanophyta, Chlorophyta, Cryptomonads, Chrysomonads, Phytoflagellates, Species composition.

The horizontal and vertical distribution of Lake Superior phytoplankton was studied from May to November/December 1973 at approximately monthly intervals from 34 stations distributed over the entire lake. Taxonomic identification and enumeration were carried out using the inverted microscope Utermoehl technique. The mean phytoplankton biomass showed a homogeneous distribution with very low biomass concentration across the lake (0.1-0.2 g/cu m). It did not show any inshore/offshore differentiation, although relatively high values were observed in the western end. On a lakewide basis the seasonal composition was dominated by the phytoflagellates (53%) and diatoms (38%), with the bluegreens and greens contributing the least. Among the phytoflagellates, Cryptophyceae (26%), Chrysophyceae (21%), and Dinophyceae (5%) were the main contributors. Lake Superior is characterized by a large number of species. Approximately 285 taxa were identified, the majority of which have not been reported before in Lake Superior or the other Laurentian Great Lakes. The offshore and open lake waters possessed large numbers of common species usually found in oligotrophic environments. However, the western end contained a limited number of common species, dominated by species of Melosira which are often associated with eutrophication. The offshore species succession revealed dominance of species usually found in oligotrophic waters. Several rare species were also identified. Some of them like Stelexmonas dichotoma Lackey and Chrysolykos planctonicus Mack were indicative of a cold-stenothermal oligotrophic environment. Vertical profiles exhibited three types of biomass-temperature relationships, one of which was the presence of a subthermocline maximum which appeared to be photosynthetically active. On the basis of biomass and species composition, Lake Superior was classified as an ultraoligotrophic environment similar to the deep, large, oligotrophic, boreal lakes. Lake Superior results, once again, emphasize the significance of phytoflagellates and nannoplankton in the algal dynamics of the Laurentian Great Lakes and demand the application of the standard Utermoehl technique in all phycological investigations. (Sims-ISWS)
W80-05271

SURFACE DISTRIBUTIONS OF AEROBIC HETEROTROPHS AND THEIR RELATIONSHIPS TO TEMPERATURE AND NUTRIENTS IN LAKE SUPERIOR DURING 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
S. S. Rao.
Journal of Great Lakes Research, Vol 4, No 3-4, p 408-414, December 1978. 4 Fig, 2 Tab, 27 Ref.

Descriptors: *Lake Superior, *Aerobic bacteria, *Water pollution, Bacteria, Oligotrophy, Lakes, Distribution, Sampling, Analysis, Surfaces, Water quality, Nutrients, Water temperature, On-site investigations, Phosphorus, Ammonia, Spatial distribution, Nitrites, Nitrates, Heterotrophs.

The distribution and densities of aerobic heterotrophic bacteria were measured in the surface layers of Lake Superior from May to November 1973, and correlated with temperature and certain nutrient levels. On a lakewide basis bacterial densities were closely related to temperature, increasing from June until September, after which their levels started to decline. A similar relationship was noted in the nearshore areas of the lake until the September-October period, after which heterotroph densities increased despite the decrease in temperature (4C) in November. The importance of psychrophilic bacterial species in the nearshore areas of the lake and the relationships between heterotrophs and nutrients in the lake were discussed. (Humphreys-ISWS)
W80-05272

CHLORINATED ORGANIC RESIDUES IN FISH, WATER, AND PRECIPITATION FROM THE VICINITY OF ISLE ROYALE, LAKE SUPERIOR,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
W. R. Swain.
Journal of Great Lakes Research, Vol 4, No 3-4, p 398-407, December 1978. 2 Fig, 5 Tab, 11 Ref.

Descriptors: *Lake Superior, *Water pollution, *Air pollution, *Pesticide residues, Polychlorinated biphenyls, Fish, Precipitation(Atmospheric), Rainfall, Lakes, Organic compounds, DDE, Sampling, On-site investigations, Analysis, DDT, Data collections, Pesticides.

Studies of persistent organic contaminants for the Upper Lakes Reference Group of the International Joint Commission indicated increased levels of organic contamination in the flesh of fish taken from the vicinity of Isle Royale on Lake Superior. Significant increases in levels of organic residues in Lake Superior fish near Isle Royale were observed in lean lake trout, Salvelinus namaycush, and in fat lake trout, Salvelinus namaycush siscowet. Siskiwit Lake, a deep cold lake on Isle Royale, well removed from the direct influences of man, was selected as a control site for studies on Lake Superior. Values for several organic residues in the flesh of fish from Siskiwit Lake were significantly higher than corresponding fish from Lake Superior. Polychlorinated biphenyls were nearly double the Lake Superior mean value, and p, p-DDE showed a more than tenfold increase in Siskiwit

Lake. These findings lead to a preliminary study of the transport of polychlorinated biphenyl compounds in atmospheric precipitation. Data from the Isle Royale area were compared with metropolitan sites and with those of other investigators. (Humphreys-ISWS)
W80-05273

ORGANOCHLORINE SUBSTANCES IN LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. J. Strachan, and G. E. Glass.
Journal of Great Lakes Research, Vol 4, No 3-4, p 389-397, December 1978. 2 Tab, 44 Ref.

Descriptors: *Lake Superior, *Water quality, *Reviews, *Pesticides, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, DDT, Dieldrin, Endrin, Sediments, Fish, Organochlorine pesticides, Chlordane.

Published and governmental reports on Lake Superior were examined for accounts of the presence of polychlorinated biphenyls (PCBs), organochlorine pesticides (OCs), and other material in environmental samples of water, sediments, and fish. PCBs, DDT residues, and dieldrin were most often examined for and observed, although levels of hetachlor epoxide, chlordane, lindane, endrin, and a-BHC were determined infrequently and several chlorobenzenes and chloronorbornenes were found. Levels of PCBs and DDT often exceed International Joint Commission water quality objectives. An inability to compare most of the data was a major problem in assessing the data. (Humphreys-ISWS)
W80-05274

A COPPER ANOMALY IN WESTERN LAKE SUPERIOR,
Canada Center for Inland Waters, Burlington (Ontario).
N. D. Warry.
Journal of Great Lakes Research, Vol 4, No 3-4, p 386-388, December 1978. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Lake Superior, *Water quality, *Metals, Copper, Hydrogen ion concentration, Lakes, Surveys, On-site investigations, Data collections, Iron, Manganese, Nickel, Analysis, Methodology.

Elevated concentrations of soluble copper up to five times greater than 'normal' mean lakewide concentrations have been observed in the Duluth arm of Lake Superior in early spring. The concentration increase is attributable to abnormally high loading in the low pH spring meltwater coupled with a lack of water movement in this part of the lake. Unfortunately, it was not possible to determine what class of soluble metal was being detected. That is, it could not be determined whether the copper was present as a free metal ion, or was bound as some labile or nonlabile metal complex, or was present as an adsorbed species. As a result, no statement regarding the potential toxicity of the increased metal concentration can be made. (Humphreys-ISWS)
W80-05275

CHEMISTRY OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
R. R. Weiler.
Journal of Great Lakes Research, Vol 4, No 3-4, p 370-385, December 1978. 9 Fig, 7 Tab, 23 Ref.

Descriptors: *Water quality, *Lake Superior, *Water chemistry, Spatial distribution, Temporal distribution, On-site investigations, Lakes, Alkalinity, Manganese, Conductivity, Metals, Ions, Copper, Zinc, Cobalt, Lead, Iron, Mercury, Cadmium, Chromium, Water temperature, Nutrients, Chlorides, Silica, Sampling, Phosphorus, Surveys, Hydrogen ion concentration, Analysis, Data collections, Nitrates, Sodium, Calcium, Magnesium, Sulfates, Potassium, Dissolved oxygen, *Trace metals.

This paper presents information on the distribution, both spatial and temporal, of major ions, trace metals, and nutrients in Lake Superior. The main source of information was the six cruises undertaken by the Canada Centre for Inland Waters in 1973, but earlier data from other sources were used to trace changes back to before 1900. It was concluded that essentially: (1) The concentration of major ions has remained constant since the beginning of the century. The quality and scarcity of data for the trace metals do not permit deductions to be made. Of the nutrients, only nitrate shows a clear trend, increasing at about 3 micrograms/L per year. (2) The waters of the lake are quite uniform both vertically and horizontally, except for the western end near Duluth. Well-defined seasonal cycles exist only for nitrates, silica, pH, and oxygen in the surface layer. These cycles are linked to the seasonal increase in plankton biomass. The geological, physical, and chemical factors that determine the chemistry of the lake were discussed, and it was concluded that Kramer's model of 1964 fits the data on major ion chemistry. In this model, the concentration of all ions, except chloride and sulfate, is determined by mixing rainwater with waters from tributaries that have reached equilibrium with minerals found in the surrounding rocks. The large discrepancies between calculated outflows and inflows of chloride, silica, total phosphorus, nitrogen, and dissolved solids, as well as the differences in the budgets calculated by different workers, suggest that a closer look has to be taken at the data and the calculations. The other possibility is that the recent concentrations in the lake are increasing slowly. (Humphreys-ISWS)
W80-05276

MAJOR ION LOADINGS TO LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
M. E. Thompson.
Journal of Great Lakes Research, Vol 4, No 3-4, p 361-369, December 1978. 2 Fig, 6 Tab, 8 Ref.

Descriptors: *Water quality, *Hydrologic budget, *Ions, *Lake Superior, Hydrology, Precipitation(Atmospheric), Chemical precipitation, Forecasting, Cations, Anions, Calcium, Magnesium, Bicarbonates, Sulfates, Chlorides, Water chemistry, Data collections, Chemical reactions, Analytical techniques.

A method of predicting tributary loadings of major ions to Lake Superior was described, making use of the water budget and chemical composition of Lake Superior, and of data on the chemistry of atmospheric precipitation on or around the lake. Predicted tributary loading were compared with tributary water chemistry, and the basic assumptions of the procedure were confirmed: chemical weathering in the basin is the principal source of calcium, magnesium, and bicarbonate ions to the lake; the atmosphere is the major source of sulfate and chloride to the lake and to its basin. Both the predicted loadings and the river chemistry loadings estimates indicate an excess loading, mainly atmospheric in origin, of chloride and sulfate, but because the lake volume is so great, increases in concentrations of these ions in the open waters of the lake will not be detectable for several decades. (Humphreys-ISWS)
W80-05277

TURBIDITY DISPERSION IN LAKE SUPERIOR THROUGH USE OF LANDSAT DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
V. Shuter, K. Stortz, G. Oman, and M. Sydor.
Journal of Great Lakes Research, Vol 4, No 3-4, p 359-360, December 1978. 2 Fig, 5 Ref.

Descriptors: *Lake Superior, *Turbidity, *Dispersion, *Remote sensing, Satellites(Artificial), Sediments, Suspended solids, Clays, Diffusivity, Winds, Mixing, Currents(Water), Water circulation, Lakes, Limnology.

Consecutive Landsat images of a red clay turbidity plume due to runoff from Nemadji River, Wisconsin, were used in computation of the horizontal eddy diffusivity for Lake Superior. Dispersion of turbid areas ranging from 2.5-5.4 km in diameter and having average velocities of 0.4 cm/sec-6.1 cm/sec were investigated. The coefficient for horizontal eddy diffusivity ranged from 0.6-1.5 sq m/sec. (Sims-ISWS)
W80-05278

WATER TRANSPARENCY OF LAKE SUPERIOR IN 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. Schertzer, F. C. Elder, and J. Jerome.
Journal of Great Lakes Research, Vol 4, No 3-4, p 350-358, December 1978. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Lake Superior, *Turbidity, *Surveys, *Sampling, On-site investigations, Phytoplankton, Light, Water temperature, Depth, Chlorophyll, Lakes, Limnology, Extinction coefficients, Water transparency.

Measurements relating to water transparency were made at roughly monthly intervals during the period May through November 1973 on Lake Superior. Spectrometer data augmented with extensive transmissometer and Secchi disc observations at a grid of stations over the lake were used to compute mean vertical extinction coefficients and photic depth for photosynthetically active radiation in the wavelength band 400-500 nm. These permitted description of the temporal and spatial variability of photic conditions throughout the major photosynthetic production period. The data showed spatial and temporal variability in water transparency between areas and, for some zones, considerable departures from the lakewide mean were evident. The mean vertical extinction ranged from approximately 0.15 to 0.25/m for the majority of zones, and relatively good correspondence was observed with seasonal changes in chlorophyll a concentration. Considerably lower rates of light attenuation occurred in the deeper midlake zones. Photic zone depth in these areas characteristically ranged from 20 to 30 meters. Reduced water transparency generally predominated along coastal areas in the proximity of Duluth, Thunder Bay, the southwest red clay portions of the lake, Apostle Islands, Nipigon-Black Bay, Marathon, and Whitefish Bay. Photic zone depths in these areas were primarily less than 20 meters throughout the photosynthetic production period. In the vicinity of Duluth, mean photic depth values of less than 10 meters were observed with extreme minimums approaching 2 meters. (Sims-ISWS)
W80-05279

SIMULATION OF WATER CIRCULATIONS AND CHLORIDE TRANSPORTS IN LAKE SUPERIOR FOR SUMMER 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
D. C. L. Lam.
Journal of Great Lakes Research, Vol 4, No 3-4, p 343-349, December 1978. 5 Fig, 16 Ref.

Descriptors: *Circulation, *Water circulation, *Chlorides, *Lake Superior, *Model studies, Mathematical models, Simulation analysis, Hydrodynamics, Mixing, Stratification, Currents(Water), Hypolimnion, Epilimnion, Pollutants, Path of pollutants, Dispersion, Upwelling, Lakes, Limnology, Chloride transport.

The mean water circulations of Lake Superior during June to September 1973, were obtained by hydrodynamical modeling. The time interval covered most of the stratification period during which the temperature data were adequately collected and analyzed. The computed results showed reasonable agreement with observed current meter readings. In particular, the generally counterclockwise circulation and some features of the Keweenaw current were obtained in the results. A computed map showing the frequent upwelling and downwelling zones was also given. These zones were often referred to in the description of the physical, chemical, and biological regimes of the lake. The computed currents provided adequate description of the advective transports during the period. By parameterizing the turbulent diffusion in an advection-diffusion model, it was

shown that the formulation proposed in previous studies appears to be also applicable for simulating the chloride transport in Lake Superior. Based on these studies, the mixing times of conservative materials were estimated to be about 2 to 3 years for Lake Superior depending on the location of the source. (Sims-ISWS)
W80-05280

WATER BUDGETS FOR LAKE SUPERIOR AND WHITEFISH BAY,
Canada Centre for Inland Waters, Burlington (Ontario).
E. B. Bennett.
Journal of Great Lakes Research, Vol 4, No 3-4, p 331-342, December 1978. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Hydrologic budget, *Precipitation(Atmospheric), *Watersheds(Basins), *Lake Superior, Rainfall, Evaporation, Hydrologic cycle, Hydrology, Water storage, Lakes, Bays, Water loss, Monthly, Data collections, Phosphorus, Networks, Runoff, Surface runoff, *Whitefish Bay(MI).

Average monthly and annual water budgets were presented for Lake Superior and for Whitefish Bay, through which water flows from the lake to discharge in St. Mary's River. Annual over-lake rainfall, estimated from monthly maps, is 93% of precipitation rate on land but accounts for 51.5% of the total input of water. Land drainage to the lake calculated from river discharge data is 7.5% higher than a previous estimate based on surface runoff. Estimates of evaporation from the lake surface, determined as the residual in the water balance, differ significantly from estimates derived by mass transfer techniques during early summer when the over-lake atmospheric boundary layer is very stable. Evaporation is the smallest term in the annual water budget, but is more than half of St. Mary's River discharge, the largest term. Diversions of water to Lake Superior have increased the mean rate of St. Mary's River discharge from 2136 to 2297 cu m/s. Relatively high rainfall and land drainage to Whitefish Bay result in reduction of flow from the main body of Lake Superior, and in principle cause a significant difference between the concentration of a material in the water of Lake Superior and that of water entering St. Mary's River. Lake Superior has the longest flushing time (177 years) among the Great Lakes, and thus concentrations of conservative materials in the lake are most sensitive to changes in loading rates and require the longest time to adjust to a change in loading. (Humphreys-ISWS)
W80-05281

ENERGY BUDGET AND MONTHLY EVAPORATION ESTIMATES FOR LAKE SUPERIOR, 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2D.
W80-05282

CHARACTERISTICS OF THE THERMAL REGIME OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
E. B. Bennett.
Journal of Great Lakes Research, Vol 4, No 3-4, p 310-319, December 1978. 10 Fig, 1 Tab, 9 Ref.

Descriptors: *Lake Superior, *Great Lakes, *Water temperature, *Heat, Lakes, Temperature, Water circulation, Stratification, Stability, Upwelling, Dissolved oxygen, Surveys, Sampling, Limnology, Thermal regime.

Among the Great Lakes, Lake Superior has the lowest summer surface temperature and mean annual lake temperature, but has the highest spring and annual heat incomes per unit area. These characteristics are associated with the large depth and width of the lake, and with relatively long periods of extensive vertical mixing during spring and fall, and short intervening periods of stratification. The thermal regime has a strong observed influence on seasonal cycles in the vertical and horizontal distribution of currents, and in turn is influenced by coastal and midlake upwelling. (Sims-ISWS)
W80-05283

ENVIRONMENTAL CLIMATOLOGY OF LAKE SUPERIOR,
Atmospheric Environment Service, Downsview (Ontario).
D. W. Phillips.
Journal of Great Lakes Research, Vol 4, No 3-4, p 288-309, December 1978. 16 Fig, 7 Tab, 17 Ref.

Descriptors: *Lake Superior, *Great Lakes, *Climatology, *Lakes, Topography, Water temperature, Stability, Precipitation(Atmospheric), Winds, Waves(Water), Fog, Humidity, Ice cover, Air pollution, Climates, Weather, Meteorology, Limnology.

Among the variety of local controls which shape the climate of the Lake Superior region, the presence of the lake itself with its large surface area and great depth is by far the most important. Climatological influences are not just confined to the immediate vicinity of the lake but are spread downwind in all directions over the entire Great Lakes system--intensifying storms, moderating temperatures, augmenting and suppressing precipitation and cloud cover, enhancing wind speeds, generating waves, etc. The annual range of surface water temperature rarely exceeds 10C. Differences in temperature between the surface water and the over-riding air are very high and positive from May through August. Consequently, occurrences of fog, pollution stagnation, and condensation are frequent during the warming period. Light, persistent winds are much less frequent over Lake Superior compared to land stations, and there is a predominant local circulation from lake to land during daytime and a reversed flow at night. The effect of the climate on the potential quality of the air-water environment is much in evidence. Even upper air stations have registered the importance of Lake Superior on mixing heights and ventilation coefficients. In recent years it has become evident that atmospheric input of sulfate to the Great Lakes is now believed to be a significant portion of the sulfate pollution of the lakes. (Sims-ISWS)
W80-05284

SEDIMENTATION RATES AND A SEDIMENT BUDGET FOR LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
A. L. W. Kemp, C. I. Dell, and N. S. Harper.
Journal of Great Lakes Research, Vol 4, No 3-4, p 276-287, December 1978. 4 Fig, 4 Tab, 36 Ref.

Descriptors: *Sedimentation rates, *Lake Superior, *Wisconsin, *Sediment distribution, Lakes, Deposition(Sediments), Sediments, On-site investigations, Bank erosion, Pollen, Rivers, Surveys, Sampling, Clays, Sands, Iron, Silts, Beach erosion, Analysis, Sediment budget, Organic carbon, Ambrosia horizon.

Present-day sedimentation rates were determined at ten offshore locations, representative of the depositional basins in Lake Superior. Sedimentation rates were calculated by averaging the weight of sediment deposited above the Ambrosia pollen horizon, dated at 1890. The rates are variable ranging from a low of 25 g/sq m/yr to a maximum value of 780 g/sq m/yr. Sedimentation rates were related to the proximity of terrestrial source, circulation patterns, and bottom topography. The highest rates were found at locations closest to the edges of the depositional basins and at the base of steep-sided troughs. The present-day sedimentation rates were proportional to the postglacial sedimentation rates at almost every locality and were half the value of the postglacial rates. A total of 6.029 million tons of fine-grained sediment is annually deposited in the lake. Erosion of the red clay bluffs of Wisconsin is the major sediment source accounting for up to 58% of the external input. Rivers contribute 30% of the external sediment load. It is calculated that the Duluth basin is the repository of 37% of the total present-day natural sediment loading to the lake. (Humphreys-ISWS)
W80-05285

SEDIMENTS OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
R. L. Thomas, and C. I. Dell.
Journal of Great Lakes Research, Vol 4, No 3-4, p 264-275, December 1978. 9 Fig, 2 Tab, 37 Ref.

Descriptors: *Lake Superior, *Sediments, *Surveys, Sampling, Geology, Glacial sediments, Bottom sediments, Bathymetry, Particle size, Chemistry, Carbon, Data processing, Lakes, Sedimentology, Limnology, Lake sediments.

Samples (406) were taken of the surficial 3 cm of sediment from Lake Superior in 1973. A description of these samples together with the interpretation of continuous echosounding records resulted in a description of the surface sediment distribution which was interpreted in the light of the glacial and postglacial evolution of the lake basin. Samples were analyzed for grain size, Eh, pH, organic and inorganic carbon. These parameters were described and related to the modern depositional environment. Eh, pH, and organic carbon reflected the current nature of the lake as being oxic and oligotrophic with low primary productivity. Grain size parameters showed distributional trends related to water depth indicating progradation from coarse to fine materials as a function of increasing water depth. (Sims-ISWS)
W80-05286

LAKE SUPERIOR BASIN AND ITS DEVELOPMENT,
Canada Centre for Inland Waters, Burlington (Ontario).
D. H. Matheson, and M. Munawar.
Journal of Great Lakes Research, Vol 4, No 3-4, p 249-263, December 1978. 8 Fig, 1 Tab, 47 Ref.

Descriptors: *Lake Superior, *Great Lakes, *Lakes, *Reviews, Water quality, Water temperature, Physical properties, Water balance, Hydrology, Circulation, Water circulation, Water chemistry, Biological communities, Pollutants, Water pollution, Nutrients, Sediments, Trace elements, Metals, Asbestos, Precipitation(Atmospheric), Limnology.

Lake Superior is unique in having the largest surface area of any freshwater lake in the world; in volume it is second only to Lake Baikal. Its location on the edge of the Canadian Shield, in a rugged land and in a northern climate, has delayed and limited the cultural development of the basin. Natural loadings to the lake are small since the bedrock is resistant to weathering; man-made pollution is slight because of the low population density in the watershed. The lake surface occupies more than one-third of the basin area with the result that direct precipitation on the lake surface is the major source of water input. Atmospheric transport is considered to be one of the most important sources of chemical loadings, the ultimate origin of which may be quite remote from the watershed. The present state of our knowledge about the Lake Superior basin was reviewed from several points of view which include the historical, geological, physical, chemical, and biological aspects. It was apparent that the influence of man-made pollution has not yet affected the lakewide water quality, and most of the lake remains in a largely unaltered oligotrophic condition. In 1972 the two bordering countries, Canada and the United States, entered into an agreement aimed at preserving this major resource. During 1976 the International Joint Commission received a report which described the baseline water quality conditions of the lake. This report provided much of the information on which managerial practices in the basin will be based during the next decade. (Sims-ISWS)
W80-05287

THE INFLUENCE OF THICK FLOATING VEGETATION (WATER HYACINTH: EICHHORNIA CRASSIPES) ON THE PHYSICO-CHEMICAL ENVIRONMENT OF A FRESH WATER WETLAND,
Bhagalpur Univ. (India). Ecology Research Lab.
For primary bibliographic entry see Field 2I.

W80-05309

HYDROLOGICAL FEATURES OF A CALIFORNIA COASTAL FEN,
California Univ., Berkeley. Dept. of Forestry and Conservation.
D. C. Erman, K. B. Roby, and M. Eames.
Great Basin Naturalist, Vol 37, No 1, p 57-66, March, 1977. 5 Fig, 3 Tab, 16 Ref.

Descriptors: *Fen, *California, *Hydrologic aspects, Wetlands, Peat, Marshes, Sediments, Magnesium, Calcium, Streamflow.

A 38.6 ha fen on the California coast depends on six streams for its supply of flowing, mineral-rich water. About 25% of the water is supplied by surface streams that had average concentrations of 0.15-0.32 meq Ca(2+)/l and 0.25-0.47 meq Mg(2+)/l. During the dry summer period, oxygen concentrations and pH were lower in the central fen area than in the margins. Water flow near the margins supports high 02, pH, and cation content levels. The fen ranges from 4 to over 11 m in depth, with the thickest peat layer being made up of very liquid, unconsolidated peat. In one year, an estimated 19.3 metric tons of suspended sediments entered the fen, which was equivalent to a 42 kg/ha loss from the total watershed. (Steiner-Mass)
W80-05310

PHOTOSYNTHETICALLY ACTIVE RADIATION IN A STAND OF PHRAGMITES COMMUNIS TRIN. IV. STOCHASTIC MODEL,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
Photosynthetica, Vol 9, No 2, p 201-210, 1975. 7 Fig, 1 Tab, 1 Append.

Descriptors: *Marsh plants, *Model studies, *Energy conversion, Wetlands, Photosynthesis, Light intensity, Plant physiology, Primary productivity.

The model inputs are the hourly sums of photosynthetically active radiation (PhAR). Its daily and seasonal course is simulated using distributions derived from previously recorded data. Two submodels (one for direct and the other for diffuse sky radiation) are introduced, each containing three compartments: PhAR intercepted by foliage, PhAR intercepted by water below the reed canopy, and PhAR reflected to the atmosphere by both the foliage and water. The daily course of radiant energy content in these compartments is simulated: the result is the regime of PhAR in a reed stand during the whole growing season. The course of radiation reaching the top of a stand canopy can be fitted to a smooth curve only under clear sky conditions. In natural weather conditions, this course is irregular and involves rapid changes due to clouds. These changes have a stochastic character: by relating them to a time scale, empirical distributions of irradiance are obtained. The actual daily course of irradiance may be simulated on the basis of distributions fitted to the empirical distributions by the generating process. In the model, hourly values of irradiance were chosen as the first approximation to the reality, but the model is not restricted to this selected scale and may be easily applied to any other time scale. (Steiner-Mass)
W80-05314

PETROGRAPHY AND PALEOECOLOGY OF HOLOCENE PEATS FROM THE OKEFENOKEE SWAMP-MARSH COMPLEX OF GEORGIA,
Southern Illinois Univ., Carbondale. Dept. of Geology.
A. D. Cohen.
Journal of Sedimentary Petrology, Vol 44, No 3, p 716-726, September, 1974. 12 Fig, 18 Ref.

Descriptors: *Swamps, *Georgia, *History, Wetlands, Marshes, Marsh plants, Peat, Palynology, Burnings.

The Okefenokee Swamp, a paludal region of over 400,000 acres is developed upon a terrace which was formerly a Pleistocene marine lagoon separated from the open ocean by a long barrier island. The lack of any salt tolerant plants in the peat at the contact with the sandy substrate suggests that some considerable length of time occurred after withdrawal of the sea and before production of the first peats. Also, the fact that the first-formed peat in all cases was a highly oxidized deposit containing residual siliceous material indicates that some thickness of previously deposited peat may have been destroyed before the onset of modern peat deposition. Palaeobotanical analyses of cores from the three largest marshes reveal that these areas have not changed greatly in vegetational and depositional environment from the beginning. In addition, the present positions of these marshes seems to be controlled by the positions or pre-peat topographic lows. Their vegetational continuity to the present day is probably related to: (1) a continuous, uniform rise in water levels, (2) the common occurrence of fires in the Okefenokee, and (3) the consistently greater depths of peat in these regions. (Steiner-Mass)
W80-05315

THE LITTORAL VEGETATION OF NORDBYTJERNET, A SMALL LAKE IN SOUTH-EAST NORWAY,
Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.
For primary bibliographic entry see Field 2I.
W80-05318

2I. Water In Plants

THE OCCURRENCE OF BRYOPHYTES ON BRITISH SALTMARSHES,
Cambridge Univ. (England). Botany School.
P. Adam.
Journal of Bryology, Vol 9, p 265-274, 1976. 1 Fig, 2 Tab, 32 Ref.

Descriptors: *Mosses, *Britain, *Salt marshes, Wetlands, Marshes, Distribution patterns, Habitat, Salt marshes, Bryophytes.

The widespread occurrence of British saltmarsh bryophytes is reported with a discussion of the communities in which the bryophytes are most frequently found. These communities are more common on marshes on the west coast of Britain. Differences between moss assemblages on slat marshes in England, Wales, and Scotland are emphasized and the greater range of habitat preference demonstrated by Grimmia maritima in Scotland is commented upon. (Steiner-Mass)
W80-05308

THE INFLUENCE OF THICK FLOATING VEGETATION (WATER HYACINTH: EICHHORNIA CRASSIPES) ON THE PHYSICO-CHEMICAL ENVIRONMENT OF A FRESH WATER WETLAND,
Bhagalpur Univ. (India). Ecology Research Lab.
D. N. Rai, and J. D. Munshi.
Hydrobiologia, Vol 62, No 1, p 65-69, 1979. 5 Fig, 1 Tab, 8 Ref.

Descriptors: *Vegetation effects, *Water hyacinth, *Microenvironment, Wetlands, Marsh plants, Aquatic plants, Floating plants, Dissolved oxygen, Water temperature, Freshwater marshes.

Dissolved 02 was generally lower, dissolved carbon dioxide higher, pH lower, and temperature fluctuations lower under areas covered by water hyacinth than in open water areas. The extent of the difference was found to be dependent upon the time of day and season. Due to extreme hypercarbic and hypoxic conditions, mostly air breathers and supplemental air breathers were found living under the hyacinth mat. Reasons for the higher carbon dioxide and lower 02 levels were the high anaerobic decomposition rate of the mat's detritus, increased respiratory activities of organisms, and decreased photosynthesis rate due to the shadowing effect of Eichhornia crops over the water surface. (Steiner-Mass)
W80-05309

TRANSPLANTING AQUATIC BRYOPHYTES TO ASSESS RIVER POLLUTION,
University Coll., Cardiff (Wales). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W80-05311

FUNGI ASSOCIATED WITH THE ROOTS OF RED MANGROVE, RHIZOPHORA MANGLE,
Hawaii Univ., Honolulu. Dept. of Botany.
B. K. H. Lee, and G. E. Baker.
Mycologia, Vol 65, p 894-906, 1973. 1 Fig, 4 Tab, 33 Ref.

Descriptors: *Mangrove swamps, *Soil fungi, *Rhizosphere, Wetlands, Swamps, Fungi, Marine fungi, Distribution patterns, Soil microorganisms, Root zone, Hawaii.

The microbial communities of root-free soil, the rhizosphere, and the rhizoplane of a red mangrove swamp in Hawaii were studied. There was a pronounced rhizosphere effect with greater numbers of bacteria, actinomycetes, and fungi occurring at all salinity levels in the rhizosphere soil than in the root-free soil at corresponding salinity levels. Primarily the microfungi isolated from the rhizoplane were known root-surface or root-tissue fungi. In the rhizosphere community, Fungi Imperfecti contributed 87.9% of the species. Phycomycetes and Ascomycetes comprised the balance. No Phycomycetes were recovered from the rhizoplane. Ascomycetes were isolated in the rhizosphere, the rhizoplane, live roots above the tidal line, and dead roots below the tidal line. Basidiomycetes and Myxomycetes were found only on live prop roots above the tidal line. Eight species of Fungi Imperfecti were predominant in the rhizosphere and rhizoplane. (Steiner-Mass)
W80-05312

AIRBORNE MULTISPECTRAL SURVEY OF INTERTIDAL VEGETATION IN ALASKA,
Environmental Research Inst. of Michigan, Ann Arbor.
F. C. Polcyn, N. E. G. Roller, S. Zimmerman, and J. Gnagy.
International Symposium of Remote Sensing of the Environment, Vol 12, p 1091-1102, 1978. 9 Fig, 3 Tab.

Descriptors: *Intertidal zone, *Marine algae, *Remote sensing, Aerial photography, Distribution patterns, Spatial distribution, Alaska, Surveys, Shores.

Digital analysis was performed on a set of multispectral data collected by a low-flying aircraft at study sites in the Gulf of Alaska for the purpose of mapping intertidal algal communities. Both supervised and unsupervised pattern recognition procedures were employed. Results show that it is possible to separate a scene into (1) broad spatial zones corresponding to vegetation density for areas of low percent cover and (2) algae types according to their taxonomic division (green, blue green, red, etc.) for areas with high levels of percent cover. Clustering techniques were found to be the most effective way to extract training signatures. A minimum of four spectral bands is needed to achieve the recognition performance levels demonstrated in this study. Two channels in the visible (green and red), one in the near-infrared region ('APPROX.' 1.0 m) and one in the thermal region were found most useful. (Steiner-Mass)
W80-05313

SIMPLE MODELS FOR CALCULATING EVAPORATION FROM DRY AND WET TUNDRA SURFACES,
Atmospheric Environment Service, Downsview (Ontario). Hydrometeorological and Environmental Impact Div.
R. B. Stewart, and W. R. Rouse.
Arctic and Alpine Research, Vol 8, No 3, p 263-274, 1976. 8 Fig, 1 Tab, 21 Ref.

Descriptors: *Evaporation, *Arctic, *Tundra, Energy budget, Model studies, Solar radiation, Air temperature, Canada, Hudson Bay lowlands.

Energy-budget calculations and equilibrium evaporation estimates from a well-drained lichen-dominated raised beach ridge and a wet sedge meadow in the Hudson Bay lowlands are presented. Energy-budget calculations reveal that on the average 54 and 66% of the daily net radiation are utilized in the evaporative process over a ridge and sedge meadow surface, respectively. For the ridge, half-hourly and daily values of evaporation were approximated closely by equilibrium estimates, while for the sedge meadow, close approximation was achieved by a model where the ratio of actual to equilibrium evaporation equals 1.26. A simple model, expressed in terms of incoming solar radiation and air temperature is developed for each surface from the comparison of actual and equilibrium evaporation. Tests of the models at different locations indicate that the actual evaporation can be estimated on a daily basis within 10% for dry upland and saturated sedge meadow surfaces. (Steiner-Mass)
W80-05316

VEGETATIONAL DEVELOPMENT AND THE EFFECT OF GEESE ON VEGETATION AT LA PEROUSE BAY, MANITOBA,
Toronto Univ. (Ontario). Dept. of Botany.
R. L. Jefferies, A. Jensen, and K. F. Abraham.
Canadian Journal of Botany, Vol 57, No 13, p 1439-1450, 1979. 6 Fig, 4 Tab, 40 Ref.

Descriptors: *Salt marshes, *Marsh plants, *Snow geese, Wetlands, Wildlife, Marshes, Arctic, Grasses, Waterfowl, Vegetation regrowth, Distribution patterns, Damages, Vegetation effects, Plant growth, Canada, La Perouse Bay(Manitoba).

The unconsolidated, water saturated sediments of the La Perouse Bay salt marshes are colonized by Hippuris tetraphylla, Puccinellia phryganodes, and Carex subspathacea. These sediments undergo frost heave, and on elevated mounds, Elymus arenarius and Salix brachycarpa become established. Where drainage is impeded in the upper marsh, relatively high salinities occur and species such as Salicornia europaea and Triglochin maritima are present. A population of 10,000-20,000 lesser snow geese feed in summer on P. phryganodes, C. subspathacea, Potentilla egedei, and E. Arenarius. The birds strip the shallow turf of P. phryganodes in low-lying areas between clumps of willow. This terracing of the surface creates depressions which become filled with water and ice. The role of geese in producing these ponds in the upper levels of salt marshes in the actic does not appear to have been reported previously. The ponds are subsequently colonized by Carex aquatilis and Triglochin maritima. The salt marsh gives way to extensive freshwater marsh dominated by species of Salix, Eriophorum augustifolium, Calamagrostis neglecta, and Dupontia fisheri. (Steiner-Mass)
W80-05317

THE LITTORAL VEGETATION OF NORDBYTJERNET, A SMALL LAKE IN SOUTH-EAST NORWAY,
Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.
D. Hongve.
Norwegian Journal of Botany, Vol 22, p 83-97, 1975. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Littoral, *Aquatic plants, *Lakes, Rooted aquatic plants, Distribution patterns, Water levels, Norway, Nordbytjernet(Norway).

In the epilittoral, the two main phytocoenoses were dominated by Carex rostrata and Calamagrostis canescens. Among the hydrophytes, three life forms dominated; namely, helophytes, nymphaeids, and elodeids. The elodeid vegetation was especially rich. The hydrophyte species were found to intermingle, and no clearly defined zones of different life forms with increasing depth were discernible, probably because of the relatively steep slope of the shore inhabited by the plants. (Steiner-Mass)
W80-05318

GROWTH, CHLOROPHYLL AND MINERAL NUTRIENT STUDIES ON PHALARIS ARUNDINACEAE L. IN THREE SCOTTISH LOCHS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
Y. B. Ho.
Hydrobiologia, Vol 63, No 1, p 33-43, 1979. 11 Fig, 6 Tab, 15 Ref.

Descriptors: *Mineral requirements, *Chlorophyll, *Plant growth, *Marsh plants, Wetlands, Marshes, Temporal distribution, Carbon, Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Iron, Scotland, Loch of the Lowes, Forfar Loch, Balgavies Loch.

Growth, chlorophyll and mineral nutrients studies were made in Phalaris arundinaceae L. in three Scottish lochs of varying nutrient status from March to November in 1975. The maximum shoot height and shoot dry weight attained by the plants were approximately 160 cm and 4 g respectively. Seasonal changes in the chlorophyll levels in the Phalaris leaf were studied and two peaks were found, one in April and the other in June-July. Maximum chlorophyll level attained was 9 mg g(-1) leaf dry weight. The changes in the mineral levels in the root, stem, leaf and inflorescence parts of the plants from the three lochs were also assayed throughout the growing season. A total of eight mineral elements were studied, including carbon, nitrogen, phosphorus, potassium, sodium, calcium, magnesium and iron. Variations in both the mineral concentrations and their pattern of changes during the study period among the plants from the lochs were observed and discussed. (Steiner-Mass)
W80-05319

BIOGENIC SEDIMENTARY STRUCTURES PRODUCED BY CRABS IN LAGOON MARGIN AND SALT MARSH ENVIRONMENTS NEAR BEAUFORT, NORTH CAROLINA,
Mount Holyoke Coll., South Hadley, MA. Dept. of Geology.
E. A. Allen, and H. A. Curran.
Journal of Sedimentary Petrology, Vol. 44, No. 2, p 538-548, June, 1974. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *Crabs, *Burrows, *Salt marshes, *Beach, *North Carolina, Wetlands, Habitats, Aquatic animals, Marshes, Deposition(Sediments), History, Intertidal areas, Distribution patterns.

Intertidal burrowing crabs produce distinctive biogenic sedimentary structures in protected lagoon margin and salt marsh evnironments. Distribution of crabs is determined primarily by substrate characteristics, salinity, and vegetation cover in the intertidal zone. Protected sand beaches and flat are heavily utilized by the sand fiddler, Uca pugilator, while backshore and foredune ridges above the high tide line are used by the ghost crab, Ocypode quadrata. Salt marshes influenced by normal to near normal salinities are burrowed by U. pugilator, Uca pugnax, and Sesarma reticulatum. U. pugnax and S. reticulatum burrow in muddy substrate areas, particularly along tidal creek banks, whereas U. pugilator is restricted to sandy substrate areas. In salt marshes where the influence of freshwater is great, Uca minax and U. pugnax are the dominant crabs. Intertidal crabs are important agents of bioturbation in the environments that they inhabit. Their burrows have excellent potential for preservation in the sedimentary record. Recognition of the record of biogenic sedimentary structures produced by intertidal crabs would be of significant value in identifying paleoenvironments, fixing ancient lagoon margin and estuarine shorelines, and determining paleosalinities. (Steiner-Mass)
W80-05320

EXPERIMENTAL DEGRADATION OF DETRITUS MADE FROM THE SALT MARSH PLANTS SPARTINA ALTERNIFLORA LOISEL., SALICORNIA VIRGINICA L., AND JUNCUS ROEMERIANUS SCHEELE,
Georgia Univ., Sapelo Island. Marine Inst.
E. B. Haines, and R. B. Hanson.
Journal of Experimental Marine Biology and Ecology, Vol. 40, p 27-40, 1979. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Marsh plants, *Degradation(Decomposition), *Efficiencies, *Detritus, Wetlands, Rates, Salt marshes, Deterioration, Marshes, Decomposing organic matter, Georgia, Sapelo Island area(GA).

The pattern of decomposition and potential food value of detritus derived from the C4 photosynthetic pathway plant Spartina alterniflora and the C3 pathway plants Salicornia virginica and Juncus roemerianus were compared. The most rapid decreases in ash-free dry weight and increases in microbial biomass were under aerobic conditions with added nitrogen. Material in aerobic treatments without added nitrogen degraded only slightly faster than in anaerobic treatments. The dissolved organic carbon (DOC) in the cultures was < 5% of the total detrital carbon; the DOC content decreased during the firt week, most rapidly in the aerobic cultures, and then began to increase slowly. Rates of nitrogen fixation in the cultures were low, and were depressed by the pressure of O2 and NH4(+), and by a higher nitrogen content of the detritus. Salicornia detritus initially degraded the fastest but showed the lowest conversion efficiency of plant material to microbial biomass (19.4%). Spartina detritus had the highest conversion efficiency (64.3%), while Juncus, which decomposed most slowly, had a conversion efficiency of 55.6%. From 87% to 100% of the increase in nitrogen content of the plant detritus is ascribed to protein-nitrogen. (Steiner-Mass)
W80-05321

ACCUMULATION OF TIN BY MANGROVE SPECIES IN WEST MALAYSIA,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
P. J. Peterson, M.A.S. Burton, M. Gregson, S. M. Nye, and E. K. Porter.
Science of the Total Environment, Vol. 11, p 213-221, 1979. 1 Fig, 5 Tab, 30 Ref.

Descriptors: *Mangrove swamps, *Metals, *Bioindicators, Wetlands, Plant physiology, Detritus, Swamps, Bioassay, Leaves, Iron, Copper, Zinc, Malaysia, Tin.

Concentrations of tin, iron, copper, and zinc were determined in the leaves of the mangrove species at various sites in West Malaysia in an analysis of the use of such plants as biogeochemical indicators. Results show that the concentrations of all the metals were higher in the leaves than in the twigs, but, whereas the concentration of tin was higher in the old leaves, that of the other three elements was higher in young leaves. A comparison of the metal concentration between Acanthus illicifolius and Rhizophora conjugata reveals that tin and iron are comparable, but zinc and copper are markedly higher in the former. A comparison of the detrital and the mangrove leaves metal concentrations reveals that a considerable increase in metal concentration has taken place in the detritus. Whether these encrichments represent selective adsorption and chemical complexation by decaying leaves or whether they illustrate accumulation by microorganisms requires further studies. Despite the complexity of mangrove ecosystems, results indicate that mangroves could be used to advantage for biogeochemical prospecting and for locating elevated metal levels resulting from pollution. (Steiner-Mass)
W80-05325

IDENTIFICATION OF PLANT FRAGMENTS AND POLLEN FROM PEAT DEPOSITS IN RANGITAIKI PLAINS AND MAKETU BASINS,
Massey Univ., Palmerston North (New Zealand). Dept. of Botany.
E. O. Campbell, J. C. Heine, and W. A. Pullar.
New Zealand Journal of Botany. Vol. 11, No. 2, 317-330, June 1973. 3 Fig, 1 Tab, 2 Ref, 1 Append.

Descriptors: *History, *Bogs, *New Zealand, Wetlands, Peat, Palyrology, Succession, Marsh plants, Spores, Pollen Soil-water-plant relationships.

From a study of plant remains (mainly roots), pollen, and fern spores preserved in the peat, it is

possible to construct a picture of the past vegetation in the bog areas on the Rangitaiki plains, New Zealand. The peat, for the most part, was a sedge peat which had developed in low moor bogs with Baumea complanata as the main peat former. There would be free water around the Beaumea clumps and around the taller clumps of Cortaderia which is often present. There were drier periods when Gleichemia, Leptospermum, Dacrycarpus, Laurelia, and associated plants tended to establish and wetter periods when the restiads (Calorophus and Sporadanthus), indicative of a raised bog, came in (Steiner-Mass)
W80-05326

ENVIRONMENTAL FACTORS IN RELATION TO THE SALT CONTENT OF SALICORNIA PACIFICA VAR. UTAHENSIS,
Brigham Young Univ., Provo, UT. Dept. of Botany.
D. J. Hansen, and D. J. Weber.
Great Basin Naturalist, Vol 35, No 1, p 86-96, March, 1975. 16 Fig, 2 Tab, 30 Ref.

Descriptors: *Plant physiology, *Salinity, *Halophytes, Wetlands, Plant growth, Salt marshes, Environmental effects, Marsh plants.

The stability of the salt content in Salicornia pacifica Standl. var. utahensis (Tidestrom) Munz in relation to environmental changes was investigated. Salicornia pacifica communities have a characteristic soil pH of 7.5 to 8.0 + or - 0.2 and a constant subsurface soil moisture level of 25 to 35 percent. The ion content in the tissue of S. pacifica remained constant despite increased moisture stress throughout the growing season. The concentrations of the salts were significantly higher in the surface soil layers than in the subsurface layers around the roots. Normal metabolic processes in the tissues of S. pacifica appear to occur even though some fluctuations in the ionic balance and concentration of ions in the plant occur. (Steiner-Mass)
W80-05327

2J. Erosion and Sedimentation

MODEL PREDICTIONS OF EFFECTS OF IMPOUNDMENT ON PARTICULATE ORGANIC MATTER TRANSPORT IN A RIVER SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. R. Webster, E. F. Benfield, and J. Cairns.
In: The Ecology of Regulated Streams, p 339-364, 1979, Plenum Publishing Corporation. 4 Fig, 1 Tab, 78 Ref.

Descriptors: *Suspended solids, *Suspended load, *Organic matter, *Impoundments, *Model studies, Simulation analysis, Sedimentation, Sediment transport, Reservoirs, Particle size, Leaves, Hydroelectric plants, Erosion, Mathematical studies, Headwaters, Upstream, Standing crops, Seston, *Particulate organic matter transport.

Three empirical equations relating elevation, stream width, and mean annual stream flow to distance were used in a model of the effects of impoundment on particulate organic matter (POM) dynamics in a river-reservoir ecosystem. The model considers the entire river system above an impoundment and for a distance downstream. Data needed to numerically parameterize the model were taken from the New River and Claytor Lake in North Carolina and Virginia. The river goes from first to sixth order and is impacted by impoundment, industrial and urban effluents, and agricultural runoff. The impoundment, a hydroelectric power dam, is located 290 km below the headwaters. Equations are presented for hydraulic parameters, reservoir parameters, biological parameters, and sedimentation and erosion. A 14-month simulation identified several areas where the model does not accurately reflect actual POM behavior including: the seasonality of allochthonous inputs, autochthonous sources of POM, filter-feeder use of POM, and deposition and resuspension of POM. Simulation results did show that POM concentration was highest during leaf fall; during leaf fall POM concentration peaked a short distance downstream from the headwaters; benthic POM was greatest just after leaf fall; and there was a consistent downstream decrease in POM standing crop. Changes occurring within and below the impoundment were also discussed. (Seigler-IPA)
W80-05116

REACTOR-RELEASED RADIONUCLIDES AND FINE-GRAINED SEDIMENT TRANSPORT AND ACCUMULATION PATTERNS IN BARNEGAT BAY, NEW JERSEY AND ADJACENT SHELF WATERS,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 5B.
W80-05130

THE EFFECT OF TIDAL RESUSPENSION ON THE DISTRIBUTION OF INTERTIDAL EPIPELIC ALGAE IN AN ESTUARY,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 2L.
W80-05132

VELOCITY PROFILES OVER A RIPPLED BED AND THE THRESHOLD OF MOVEMENT OF SAND,
Institute of Oceanographic Sciences, Taunton (England).
For primary bibliographic entry see Field 2L.
W80-05133

POINT BAR AND FLOODPLAIN FORMATION OF THE MEANDERING BEATTON RIVER, NORTHEASTERN BRITISH COLUMBIA, CANADA,
Wollongong Univ. (Australia). Dept. of Geography.
G. C. Nanson.
Sedimentology, Vol 27, No 1, p 3-29, February 1980. 25 Fig, 1 Tab, 53 Ref.

Descriptors: *Flood plains, *Sedimentology, *Channel morphology, *Canada, On-site investigations, Meandering, Rivers, Stratigraphy, Particle size, Sediments, Velocity, Distribution patterns, Alluvial channels, Deposition(Channels), Sediment transport, Currents(Water), Beatton River(British Columbia), Point bars, Scroll bars, Secondary currents.

This study examined the morphology, sedimentology, and genesis of the point bars and floodplain of the Beatton River. The Beatton River, a 500 km tributary of the Peace River, drains an area of 16,070 sq km near Fort St. John, northeastern British Columbia, Canada. The formation of point bass occurs in distinct stages. An initial point bar platform composed mainly of coarse sediment is formed adjacent to the convex bank of a migrating meander bend and is the base on which develops a single scroll bar of fine traction and suspended load. With continued sedimentation, the scroll bar grows, eventually supporting vegetation and becoming a floodplain ridge. Scroll bars form with greatest size and frequency in rapidly migrating bends, and the shape of the meander bend appears to determine both the location of the initial bar deposit and its direction of growth up or downstream. Approximately one-half of the floodplain sediment is derived from suspended load, and the initiation of a scroll bar appears to be due to excessive deposition of suspended load in a zone of flow separation over a point bar platform. The critical flow condition for the initiation of a scroll bar does not occur with the same recurrence interval on different shaped meander bends, however, the average recurrence interval within the study reach is approximately every 30 years. Sedimentation rates on point bars and on the floodplain indicate two relatively distinct stages of floodplain alluviation. The most rapid is for surfaces less than 50 years old, although sediment accumulation still persists on surfaces up to 250 years in age. Although frequently flooded, surfaces older than this accumulate very little sediment. Despite 2-3 m of overbank deposition, the amplitude of floodplain ridges is maintained by secondary currents which sweep sediment from the swales towards the ridge crests. (Humphreys-ISWS)
W80-05144

A PHYSICAL MODEL FOR THE TRANSPORT AND SORTING OF FINE-GRAINED SEDIMENT BY TURBIDITY CURRENTS,
Dalhousie Univ., Halifax (Nova Scotia).
D. A. V. Stow, and A. J. Bowen.
Sedimentology, Vol 27, No 1, p 31-46, February 1980. 11 Fig, 2 Tab, 87 Ref.

Descriptors: *Sediment transport, *Sediment sorting, *Turbidity currents, *Model studies, Sedimentation, Density currents, Turbidity, Deposition(Sediments), Rates, Clays, Silts, Analytical techniques, Particle size, On-site investigations, Mathematical models.

Turbidite muds in cores from the outer Scotian continental margin, off eastern Canada, contain abundant thin silt laminae. Graded laminated units are recognized in parts of this sequence. These represent single depositional events and show a regular decrease in modal grain size and thickness of the silt laminae through the unit. A similar fining trend is shown by both silt and mud layers over hundreds of kilometers downslope. Textural analysis of individual laminae allows the construction of a dynamically consistent physical model for transport and sorting in muddy turbidity currents. Hydraulic sorting aggregates finer material to the top and tail regions of a large turbidity flow which then overspills its channel banks. Downslope lateral sorting occurs with preferential deposition of coarser silt grains and larger mud flocs. Depositional sorting by increased shear in the boundary layer separates clay flocs from silt grains and results in a regular mud/silt lamination. Estimates can be made of the physical parameters of the turbidity flows involved. They are a minimum of several hundreds meters thick, have low concentrations (of the order of 0.001 or 2500 mg/l), and move downslope at velocities of 10-20 cm/s. A 5 mm thick, coarse silt lamina takes about 10 h to deposit, and the subsequent mud layer 'blankets' very rapidly over this. A complete unit is deposited in 2-6 days which is the time it takes for the turbidity flow to pass a particular point. These thick, dilute, low-velocity flows are significantly different from the 'classical' turbidity current. However, there is mounting evidence in support of the new concept from laboratory observations and direct field measurements. (Humphreys-ISWS)
W80-05145

A SMALL CLIFF-BOUND ESTUARINE ENVIRONMENT: SANDYHAVEN PILL IN SOUTH WALES,
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 2L.
W80-05146

ESTIMATING THE C FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION FOR LANDSCAPED SLOPES,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar, J. J. Ross, and R. L. Cunningham.
Journal of Soil and Water Conservation, Vol 35, No 1, p 40-41, January-February 1980. 2 Fig, 5 Ref.

Descriptors: *Soil erosion, *Erosion, *Mathematical models, *Equations, Model studies, Vegetation effects, Mulching, Trees, Canopy, Shrubs, Grasses, Landscaping, Raindrops, Rainfall, Universal soil loss equation.

The cropping and management factor, C, in the universal soil loss equation has not been measured on landscaped sites common in urban areas. Combinations of trees, shrubs, and groundcover can make the problem seem difficult to handle. Although such sites are usually heavily mulched soon after construction, the mulch deteriorates within a few years, leaving many areas subject to erosion. Wischmeier addressed the problem of soil losses on undisturbed areas, such as woodlands. His ap-

proach was modified to handle the problem in landscaped areas. This procedure represents the best method available for estimating the C factor for landscaped areas in the universal soil loss equation. (Sims-ISWS)
W80-05147

ESTIMATING THE C FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION FOR LANDSCAPED SLOPES: A FIELD RATING SYSTEM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
J. J. Ross, W. R. DeTar, and R. L. Cunningham.
Journal of Soil and Water Conservation, Vol 35, No 1, p 42-44, January-February 1980. 2 Tab, 6 Ref.

Descriptors: *Soil erosion, *Erosion, *Mathematical models, *Equations, Model studies, Vegetation effects, Mulching, Trees, Canopy, Shrubs, Grasses, Landscaping, Raindrops, Rainfall, Universal soil loss equation.

Use of ornamental trees, shrubs, and groundcovers for erosion control is common on steep slopes in urban areas. Organic mulches, such as wood chips, are often used immediately after planting to protect soil and conserve moisture for plants. These mulches effectively control erosion. Despite this initial protection, little attention has been given to these plantings to determine the amount of cover provided by established plants after the mulch has deteriorated. The problem of evaluating cover effectiveness and making recommendations for the use
W80-05148

HYDROSEEDING FOREST ROADSIDES IN BRITISH COLUMBIA FOR EROSION CONTROL,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 4D.
W80-05149

DESCHUTES RIVER BASIN SUSPENDED SEDIMENT TRANSPORT STUDY,
Washington State Dept. of Ecology, Olympia.
A. Moore, and D. Anderson.
Project Report DOE-PR-7, July 1979. 24 p, 8 Fig, 1 Tab, 49 Ref.

Descriptors: *Sediment discharge, *Rivers, *Washington, *Suspended load, Sediment transport, Data collections, Suspended solids, Turbidity, Stream erosion, Bank erosion, Monitoring, Tributaries, River systems, *Deschutes River(WA).

The Deschutes River was dammed at its mouth in 1951 forming Capitol Lake, a 220-acre impoundment that is used for salmon culturing (Percival Cove) and a variety of recreational activities. The State of Washington, which is responsible for maintaining the lake, conducted the first major dredging operation during the 1978-79 winter. It became apparent during the planning of the Capitol Lake dredging project that insufficient information was available concerning the sources of the sediments that are reaching the lake. Therefore, during 1976-78, the Department of Ecology conducted sediment monitoring at selected locations in the Deschutes watershed. The study included two objectives: (1) identify sources of sediments transported by the Deschutes River; and (2) determine the quantity and significance of sediments contributed by each of the sources identified. This report presented and discussed the results of the 1977-78 monitoring effort. An estimated 3,043 tons (25%) of the 12,233 tons of suspended sediment originating from the upper Deschutes basin during November and December 1977 came from the tributaries monitored. The stream banks and channel appeared to account for the 9,190 ton (75%) difference. Another 6,029 tons was picked up along the lower Deschutes, nearly all of which appeared to come from the mainstem. These results indicate that the majority of the 18,262 tons (67%) of suspended sediments transported to Capitol Lake originated from the streambed and banks along the mainstem itself. (Humphreys-ISWS)
W80-05153

MATHEMATICAL MODELING OF SEDIMENT AND CONTAMINANT TRANSPORT IN THE JAMES RIVER ESTUARY,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi, and S. E. Wise.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 303-310, 1978. 7 Fig, 12 Ref, 1 Append. DOE EY-76-C-06-1830.

Descriptors: *Sediments, *Pollutants, *Rivers, *Mathematical models, Model studies, Sediment transport, Path of pollutants, Pesticides, Heavy metals, Nutrients, Radioactive wastes, Mathematics, Equations, Calibrations, Water pollution, Estuaries, *James River Estuary(VA).

Various contaminants (e.g., pesticides, heavy metals, nutrients, and radionuclides) discharged to surface waters are dispersed by currents, surface waves, and turbulent mixing. These contaminants are also adsorbed from solution onto sediment; thus, otherwise dilute contaminants are concentrated. This process may create a significant pathway to man. For example, contaminated sediments may be deposited onto river and ocean beds. Contaminated bed sediments in turn may become a long-term source of pollution through desorption and resuspension. In contrast, sorption by sediment can be an important mechanism for reducing the area of influence of these contaminants by reducing concentrations of dissolved constituents. To identify the effects of sediment transport on contaminant migration, the finite element sediment and contaminant model (FETRA) was applied to the James River estuary. The modeling procedure for FETRA involved simulating the transport of sediments (organic and inorganic materials) within the water body. The results were then utilized to simulate dissolved and particulate contaminants by taking into account interaction with the sediments. Finally, changes in river bed conditions were calculated including: (1) river bottom elevation change, (2) distributions of ratio of each bed sediment component in the bed, and (3) distribution of contaminants in the river bed. (See also W80-05159) (Sims-ISWS)
W80-05185

SEDIMENT TRANSPORT IN MIGRATING BED FORMS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. C. Willis, and J. F. Kennedy.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 551-560, 1978. 4 Fig, 23 Ref, 1 Append.

Descriptors: *Sediment transport, *Laboratory tests, *River beds, *Sediment discharge, Shape, Bed load, Dunes, Alluvial channels, Ripple marks, Mathematical models, Equations, Analytical techniques, Data collections, Statistical methods.

In recent years, application of spectral or time-series analysis to the description of sedimentary dunes has been quite successful. The objectives of the study reported were to develop a more rigorous formulation of dune-load transport based on a spectral description of the dune profiles and movement; to obtain detailed data on sediment transport and dune geometry and motion from a series of carefully conducted flume experiments; and to examine these and other flume data in the light of the new formulation with the goal of developing an improved predictor for the total-load discharge of alluvial streams. A series of 34 experiments was conducted in the 50 ft long, 1.18 ft wide, 2 ft deep, tilting, recirculating flume to obtain the detailed data required to verify the analytical model developed in this paper. Sieved quartz sand, retained between 0.5 mm and 0.7 mm sieves, was used. A detailed size analysis of the sediment gave a median particle size of 0.54 mm, and a median fall diameter of 0.50 mm. In view of the experimental results and the rigorous derivations leading to the duneload discharge relation, the equation not only extends stochastic analysis of bed forms beyond the realm of primarily a descriptive tool but also serves as a promising means for determining the dune-load discharge when bed elevation records are available. (See also W80-05159) (Humphreys-ISWS)
W80-05207

STOCHASTIC ASPECTS OF WATERSHED SEDIMENT YIELD,
Colorado State Univ., Fort Collins.
D. A. Woolhiser, and K. G. Renard.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 561-567, 1978. 1 Fig, 14 Ref.

Descriptors: *Watersheds(Basins), *Sediment yield, *Mathematical models, Sediment transport, Sediment discharge, Stochastic processes, Model studies, Theoretical analysis, Analytical techniques, Monte Carlo method, Rainfall, Runoff, Effects.

The sediment yield process may be divided into two categories--the upland phase and the lowland phase. Sediment detachment and transport processes predominate in the upland phase and depend on individual rainfall (or snowmelt) events. The magnitude of erosion from upland phase depends on factors like slope steepness and shape, cover, soil type, land use, and rainfall characteristics. In the lowland phase, sediment transport and deposition processes predominate, and the bed load transport capacity becomes a significant factor because channel flow is normally capable of transporting all the fine material available. Sediment transport rates are determined by hydraulic variables, like the flow depth and velocity, channel slope, water temperature, and physical properties of the sediments. The effect of individual precipitation events is highly damped. From examples in the literature, it appears that stochastic models of sediment yield have important application in design of dams, debris-basins, and other hydraulic structures. The approaches used in developing stochastic sediment yield models range from detailed, physically based models with distribution functions obtained by sampling from Monte Carlo simulations to empirical, event-based models for which distribution functions of sediment yield can often be obtained analytically. The best approach for any particular application depends greatly on the available data as well as the size of the watershed. (See also W80-05159) (Humphreys-ISWS)
W80-05208

ESTIMATING THE RISK OF CHANNEL EROSION,
Colorado Univ. at Denver. Dept. of Civil Engineering.
W. C. Hughes.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 568-573, 1978. 2 Fig, 1 Ref, 1 Append.

Descriptors: *Channel erosion, *Estimating, *Analytical techniques, *Risks, Data collections, Analysis, Erosion, Discharge(Water), Mathematical models, Statistical methods, Stream erosion, Soils, Sands, Gravels, Clays, Probability, Silts, Erosion potential.

The objective of the study described was to develop a method for estimating the potential for channel erosion, which would incorporate the random tendency of the variables while retaining data and computational requirements comparable to the permissible velocity method. The study involved two phases: The first phase was an analysis of field data to develop curves relating the probability of significant erosion in a channel to flow rate, hydraulic characteristics, and soil conditions. These curves were referred to as erosion potentials. The second

phase was the derivation of a procedure for combining a channel's erosion potential with the channel's discharge frequency curve to yield the probability, or risk, of erosion in a given reach of stream channel. The latter provides a method for accounting for situations where the likelihood of erosion is quite low, even in a highly erodible channel, simply because erosion-producing discharges occur infrequently. The proposed method provides a quick means to estimate the erosion risk in a stream channel using data which is normally available. The method cannot replace an extensive erosion survey but was not intended to do so. The sand-silt, silt-clay, and clay erosion potential diagrams have an acceptable degree of statistical reliability although upper boundary on clay erosion potential diagram is somewhat questionable. The gravel-silt erosion potential diagrams are of marginal statistical reliability. When channel discharges exceed 10 cfs, the risk of channel erosion can be estimated directly from the appropriate erosion potential diagram. (See also W80-05159) (Humphreys-ISWS)
W80-05209

SEDIMENT AND PCB TRANSPORT MODEL OF THE HUDSON RIVER,
Lawler, Matusky and Skelly Engineers, Pearl River, NY.
G. A. Apicella, and T. F. Zimmie.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 645-653, 1978. 2 Fig, 2 Tab.

Descriptors: *Model studies, *Sediment transport, *Polychlorinated biphenyls, *Hudson River, Mathematical models, Sediments, Rivers, Deposition(Sediments), Bed load, Scour, On-site investigations, Calibrations, Methodology, Analytical techniques, Sediment discharge, *Lock 7(NY), *Troy dam(NY).

The purpose of this study was to model mathematically the transport of PCB-contaminated sediments through a 40-mile segment of the Upper Hudson River. Furthermore, because PCBs were recognized to be present in both the river bed and water column partitions of the river system, the major objectives were to analyze the stability of the PCB-laden sediments lying on the river bed and project the contaminant loading of the upper river to the estuary. The area modeled includes approximately 40 miles of the Hudson River between Lock 7 (RMI 193.7) and the Troy dam (RMI 153.9), and represents a total drainage area of 8090 sq mi. A series of eight dams divides this portion of the river into eight reaches defined as the extent of river from oe dam to the next. A systems analysis approach to the study consisted of various submodels that relate the quantity of flow through the river to an associated sediment load, which contains a certain mass of PCB in transport. This analysis which assumes the continuation of natural river conditions serves as a benchmark for comparing various remedial action programs. This modeling framework is capable of assessing the effects of various remedial alternatives and should be applied to the partial dredging program currently under consideration. (See also W80-05159) (Humphreys-ISWS)
W80-05219

SEDIMENT MOVEMENT IN A SMALL HUMID WATERSHED,
Hawaii Univ., Honolulu.
P. D. Bartram, and G. L. Dugan.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 654-661, 1978. 3 Fig.

Descriptors: *Sediment transport, *Small watersheds, *Hawaii, *Model studies, Sedimentation, On-site investigations, Suspended solids, Suspended load, Turbidity, Storm runoff, Deposition(Sediments), Analysis.

Water quality standards pertaining to sediments require some kind of mathematical model. It is advantageous for water quality management if such models are fairly simple and highly transferrable to situations other than the areas where they are first developed and calibrated. This paper examined three different approaches--criteria or standards--that might have been applied to a perennial stream discharging to a large embayment in Hawaii. Each standard was useful for a limited part of the overall range of sediment pollution. Turbidity was the best indicator of sediment problems during low flow periods; suspended sediment concentration arrayed in a log-normal distribution was the best indicator of deviations for storm flow events up to the most extreme occurrences; and the thickness of sediment deposited over living corals on the reef was the best indicator for the most extreme storm runoff events. Most of the documented sediment damage to reef ecology in Kaneohe Bay was associated with extreme flood events, which occurs when the rate of sediment deposit exceeds the rate of removal by waves and the self-cleansing ability of the coral animals themselves. If the thickness exceeds 0.12 inch for a period of even one day, the more silt-resistant species of coral would be smothered to death. (See also W80-05159) (Humphreys-ISWS)
W80-05220

A SEDIMENT YIELD ROUTING MODEL,
Science and Education Administration, Temple, TX.
J. R. Williams.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 662-670, 1978. 2 Tab, 5 Ref.

Descriptors: *Sediment yield, *Routing, *Mathematical models, *Agricultural watersheds, Model studies, Equations, Deposition(Sediments), Degradation(Stream), Analytical techniques, Analysis, Bed load, Open channels, Sediment discharge, Sediment routing model.

A model for routing individual storm sediment yields through large agricultural basins was described. The model consists of two components for simulating the deposition and degradation processes. Deposition depends upon sediment particle size and the change in peak flow rate within a routing reach. The deposition model was developed previously but was restructured here to exclude channel and floodplain degradation. Previously, the sediment routing model contained a crude degradation component based on MUSLE. A new degradation model based on stream power was developed in this paper. One of the stream power parameters, evaluated for bed load prediction, was used in the degradation model. A technique was developed for estimating the other parameter. Although more work is needed to validate the parameter estimates, the stream power approach has a stronger physical basis than the previous degradation model. Also, the new model outputs sediment graphs resulting from degradation. Only the total degradation could be predicted with the original model. Tests with data from three Texas basins showed that the sediment-routing model gives realistic predictions. The model should be useful in determining nonpoint source pollution because it operates on individual storms and identifies subbasin contributions. (See also W80-05159) (Humphreys-ISWS)
W80-05221

FIELD TEST OF A DISTRIBUTED SEDIMENT YIELD MODEL,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. V. Alonso, D. G. DeCoursey, S. N. Prasad, and A. J. Bowie.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 671-678, 1978. 7 Fig, 6 Ref.

Descriptors: *Sediment yield, *Small watersheds, *On-site tests, *Model studies, Hydrographs, Sediments, Discharge(Water), Erosion, Analysis, Forecasting, Runoff, Sediment discharge, Sediment yield model.

This paper described a computational model for predicting the unsteady movement of water and sediment generated by single runoff events. The model basically consists of two intertwined models: one describing the hydrology of the basin, the other describing the associated erosion and sedimentation processes. The present model simulates the movement of water and sediment as a time and space distributed process, and it has the ability of distinguishing between overland and channel flows. The watershed is regarded as consisting of a mosaic of individual but interconnected subcatchments. Within each of these subcatchments, the characteristics of the terrain and precipitation distribution are assumed uniform. The model can thus be regarded as a cascading process in which the output of one or more subcatchments becomes the input to another subcatchment or channel reach. In mimicking the overland movement of water and sediment, the model simulates processes of interception, infiltration, runoff, detachment, transport, and deposition of sediment. The water and sediment reaching the streams are then routed through the channel system, and the rates of channel aggradation and degradation are computed. The applicability of the model is restricted, so far, to watersheds where the streamflows are ephemeral, the subsurface flow and groundwater movement are not significant, and the kinematic wave approximation for flow routing is valid. (See also W80-05159) (Humphreys-ISWS)
W80-05222

FIELD VERIFICATION OF SEDIMENT TRANSPORT MODEL,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
For primary bibliographic entry see Field 2L.
W80-05228

THE LOYALSOCK CREEK MODEL STUDY,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-05229

SEDIMENT MODEL VERIFICATION FOR SMALL DIVERSIONS,
Water and Power Resources Service, Denver, CO.
R. A. Dodge.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 753-758, 1978. 2 Tab, 1 Ref.

Descriptors: *Model studies, *Sediments, *Diversion, Calibrations, Sediment transport, Hydraulic models, Methodology, Sediment load, Roughness(Hydraulic), Roughness coefficient, Froude number, Hydraulics, Hydraulic similitude, Model verification.

Normalized equations, whether solvable or not, aid in the design and verification of a model by showing what dimensionless parameters are involved and what groups of dimensionless variables for which they are coefficients. Verification should be directed to finding the values of these parameters for both the model and prototype, then the modeler can determine for what ranges the model is valid, and in some cases the error of some of the variables can be determined and possibly corrected if distortion is not too great. For coarser bed materials, the portion of the grain distribution that governs roughness can also nearly scale geometrically. Thus, both friction and relative roughness can be the same for model and prototype. Verification data, especially for a rehabilitation model, help develop a base for the existing system to compare proposed modifications in a more quantitative way. For sediment models of small diversions the modeler is dependent upon the skill of hydrologists in making flow duration analyses computation of water surface levels and sediment load to augment scarce field data. Adequate verification effort can help substantiate bed sampling, computed hydrologic estimates, and mathematical models as well as the physical modeling techniques used. (See also W80-05159) (Humphreys-ISWS)

W80-05230

BED LOAD: DEFINITION AND MEASUREMENT,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 7B.
W80-05231

A FACTOR ANALYSIS OF ELEMENTAL ASSOCIATIONS IN THE SURFACE MICROLAYER OF LAKE MICHIGAN AND ITS FLUVIAL INPUTS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 2H.
W80-05254

SEDIMENTATION RATES AND A SEDIMENT BUDGET FOR LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05285

SEDIMENTS OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05286

RECONNAISSANCE ASSESSMENT OF EROSION AND SEDIMENTATION IN THE CANADA DE LOS ALAMOS BASIN, LOS ANGELES AND VENTURA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Knott.
Available from GPO Washington DC 20402. Paper copy $2.00. Geological Survey Water-Supply Paper 2061, 1980. 26 p, 15 Fig, 2 Tab, 16 Ref.

Descriptors: *Sediment yield, *Mechanical equipment, *Accelerated erosion, *Erosion rates, Evaluation, California, *Off-road vehicles, Ventura County(Calif), Los Angeles County(Calif), Hungry Valley, Canada de Los Alamos.

An assessment of present erosion and sedimentation conditions in the Canada de Los Alamos basin, Calif., was made to aid in estimating the impact of off-road-vehicle use on the sediment yield of the basin. Evaluations were made by reconnaissance techniques and by comparing the study area with other off-road-vehicle sites in California. Major-storm sediment yields for the basin were estimated, using empirical equations developed for the Transverse Ranges and measurements of gully erosion in a representative off-road vehicle basin. Normal major-storm yields of 73,200 cubic yards would have to be increased to about 98,000 cubic yards to account for the existing level of accelerated erosion caused by off-road vehicles. Long-term sediment yield of the Canada de Los Alamos basin upstream from its confluence with Gorman Creek, under present conditions of off-road-vehicle use, is approximately 420 cubic yards per square mile per year--a rate that is considerably lower than a previous estimate of 1,270 cubic yards per square mile per year for the total catchment area above Pyramid Lake. (Kosco-USGS)
W80-05305

OIL SPILL VULNERABILITY, COASTAL MORPHOLOGY, AND SEDIMENTATION OF KOTZEBUE SOUND,
South Carolina Univ., Columbia. Div. of Coastal Research.
For primary bibliographic entry see Field 5C.
W80-05339

BOTTOM AND NEAR-BOTTOM SEDIMENT DYNAMICS IN LOWER COOK INLET,
Geological Survey, Menlo Park, CA. Branch of Pacific-Arctic Marine Geology.
For primary bibliographic entry see Field 5B.
W80-05349

SOURCES, TRANSPORT PATHWAYS, DEPOSITIONAL SITES AND DYNAMICS OF SEDIMENTS IN THE LAGOON AND SHALLOW MARINE REGION, NORTHERN ARCTIC ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.
W80-05354

2K. Chemical Processes

GROWTH INHIBITION OF HYDRILLA VERTICILLATA BY SELECTED LAKE SEDIMENT EXTRACTS,
Southwest Florida Water Management District, Brooksville.
For primary bibliographic entry see Field 2H.
W80-05258

A COPPER ANOMALY IN WESTERN LAKE SUPERIOR,
Canada Center for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05275

CHEMISTRY OF LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05276

MAJOR ION LOADINGS TO LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05277

2L. Estuaries

APPROXIMATION FOR SALT-WATER INTRUSION IN UNCONFINED COASTAL AQUIFER,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
B. K. Panigrahi, A. Das Gupta, and A. Arbhabhirama.
Ground Water, Vol 18, No 2, p 147-151, March-April 1980. 5 Fig, 16 Ref.

Descriptors: *Saline water intrusion, *Coasts, *Aquifers, *Model studies, Mathematical models, Saline water-freshwater interfaces, Equations, Groundwater, Groundwater movement, Permeability, Water levels, Density, Unconfined coastal aquifers.

A numerical model based on a finite difference technique was developed to analyze and solve the problem of an unconfined coastal aquifer of infinite extent with free surface and interface along with the width of outflow face as unknown boundaries. The problem was formulated in a complex potential plane, and a five-point operator of a finite difference scheme was used to reduce the governing flow equation into a set of linear algebraic equations which was solved by the Gauss-Seidel iterative method with an overrelaxation factor. Results of the analysis provided a generalized dimensionless plot for assessing the freshwater flow to the sea from the known field information of aquifer characteristics and water-table head landward from the shoreline. (Sims-ISWS)
W80-05126

THE EFFECT OF TIDAL RESUSPENSION ON THE DISTRIBUTION OF INTERTIDAL EPIPELIC ALGAE IN AN ESTUARY,
Connecticut Univ., Groton. Marine Sciences Inst.
P. W. Baillie, and B. L. Welsh.
Estuarine and Coastal Marine Science, Vol 10, No 2, p 165-180, February 1980. 10 Fig, 2 Tab, 50 Ref. Army DACW 33-75-C-0059.

Descriptors: *Estuaries, *Algae, *Chlorophyll, *Suspended solids, *New England, Sampling, On-site investigations, Laboratory tests, Zooplankton, Diatoms, Benthic flora, Biomass, Microorganisms, Biological communities, Sediments, Tides, Tidal effects, Circulation, Water circulation, Biology, Mud flats, Coasts, Resuspension.

The distribution of microalgal biomass in the sediments and water column of a salt marsh and mudflat ecosystem was studied over a 15-month period by fluorometric analysis of chlorophyll a. Chlorophyll entered the water column on the early flood tide due to the resuspension of intertidal mudflat sediments and associated epipelic algal flora. By mid-flood tide, chlorophyll values were surpassed by its degradation products. Unusually large numbers of bivalves and other suspension feeders present in the system may have processed the water and released fecal materials, thus raising the concentration of pheopigment in the water column between early and mid-flood tide. By mid-ebb, the pigment levels had declined, possibly due to the settling of algal cells and feces. Resuspension recommenced briefly by late ebb as the system emptied. Calculations revealed that if 10 to 15% of the mudflat sediments were resuspended to a depth of 1 mm, it could account for the chlorophyll levels inside the estuary which were high compared to neighboring systems. Pigment gradients in the water column and sediments indicated net transport of epipelic algae from the mudflat to the salt marsh where most of the bivalves were located. Suspended material concentrations as well as counts of epipelic and phytoplankton furstules suggested that epipelic algae in shallow estuarine systems may be an important food source for the filter feeding community when made available twice daily by tidal resuspension of sediments. (Sims-ISWS)
W80-05132

VELOCITY PROFILES OVER A RIPPLED BED AND THE THRESHOLD OF MOVEMENT OF SAND,
Institute of Oceanographic Sciences, Taunton (England).
K. R. Dyer.
Estuarine and Coastal Marine Science, Vol 10, No 2, p 181-199, February 1980. 12 Fig, 1 Tab, 28 Ref.

Descriptors: *Ripple marks, *Sediment transport, *Sands, *Coasts, Tides, Tidal effects, Circulation, Water circulation, Shear stress, Velocity, Sediments, On-site investigations, Current meters, Data processing, Analytical techniques, Roughness(Hydraulic), Flow friction, Oceanography, *England coast.

Measurements of velocity profiles were obtained within 2m of the sea bed over a rippled sand in Start Bay, Devon, U.K. Simultaneous observation by underwater television has enabled the threshold of movement of the sand to be determined. The threshold criteria are considerably higher than laboratory measurements for a flat bed. As the sand moves, the ripples change their shape. This causes a change in the bottom roughness length, the drag coefficient, and the apparent threshold of sand movement during the tidal cycle. The bottom roughness length and the threshold of movement also increase with decreasing tidal amplitude. The calculated suspended sediment concentration at the height of bed roughness length was proportional to the normalized excess shear stress with a constant of proportionality of 0.000078. The concentration at a height of 10 cm was proportional to (u sub *) to the 5th power. (Sims-ISWS)
W80-05133

REGULATION OF SULFATE CONCENTRATIONS AND METHANOGENESIS IN SALT MARSH SOILS,
Georgia Univ., Athens. Dept. of Microbiology.
G. M. King, and W. J. Wiebe.
Estuarine and Coastal Marine Science, Vol 10, No 2, p 215-223, February 1980. 4 Fig, 1 Tab, 29 Ref.

NSF DES75-20842.

Descriptors: *Salt marshes, *Soil properties, *Sulfates, *Methane, *Georgia, Coasts, Soils, Vegetation, Vegetation effects, Grasses, Marshes, Sampling, Cores, Laboratory tests, Chemistry, Soil chemistry, Soil tests, Soil science, *Georgia coast, Methanogenesis, Salt marsh soils.

Controls of methanogenesis in soils of Sapelo Island, Georgia, salt marshes were investigated by altering water movement through soils of the tall Spartina alterniflora region (TS). Vertical water movement was shown to maintain the concentration of sulfate at levels near that of the tidal waters which flood the TS. Restriction of vertical water movement resulted in a decrease of interstitial sulfate concentration by a factor of 2-5 over a period of 2 months. This decrease in sulfate was accompanied by a marked increase in vitro methane production. Sulfate depletion was postulated to occur in microzones within the soil; methane formation occurs subsequent to this depletion. In situ differences between methanogenesis in TS and SS regions were suggested to be the result of such depletion. (Sims-ISWS)
W80-05134

A PHYSICAL MODEL FOR THE TRANSPORT AND SORTING OF FINE-GRAINED SEDIMENT BY TURBIDITY CURRENTS,
Dalhousie Univ., Halifax (Nova Scotia).
For primary bibliographic entry see Field 2J.
W80-05145

A SMALL CLIFF-BOUND ESTUARINE ENVIRONMENT: SANDYHAVEN PILL IN SOUTH WALES,
Reading Univ. (England). Sedimentology Research Lab.
C. J. H. King.
Sedimentology, Vol 27, No 1, p 93-105, February 1980. 7 Fig, 2 Tab, 28 Ref.

Descriptors: *Estuaries, *Estuarine environment, *Deposition(Sediments), *On-site investigations, Tidal waters, Stratigraphy, Geomorphology, Erosion, Bank erosion, Aquatic life, Sediments, Aquatic plants, Aquatic animals, Biota, Spatial distribution, United Kingdom, *Sandyhaven Pill(South Wales), Cliff erosion.

Sandyhaven Pill is a 'drowned valley' type of estuary. Thus the deposits differ from most other described estuarine deposits which are of 'tidally influenced river' type. The surface sediments may be divided broadly into wave-dominated deposits (22% of area), tide-dominated deposits (65%), deposits related to marginal cliff collapse (12%), and river-dominated deposits (1%). Further subdivision shows that the subenvironments are nested in a progression up the estuary with trends to finer sediment size, reduced sorting, and increased biogenic activity. The latter relates to a marine to estuarine faunal change and a strong relationship between the distributions of biota and depositional subenvironments. Over a 29 day period, reduction in wave height was reflected in wave-dominated areas by shoreward movement of some subenvironment boundaries and by improved definition of symmetrical ripples. The tidal cycle had only a limited effect on the tide-dominated sediments. The most reliable indicators of estuary trend are channels and asymmetrical ripples; but coring shows that ripples and other minor structures are rarely preserved. Heavy mineral analysis indicates that most of the estuarine sand came from offshore. Gradual sediment buildup will result in a regressive sequence. If this were preserved under a later transgression, the resultant deposit would be an elongate sediment body bounded laterally by a coarse marginal facies. The sediment sequence would be inward and upward fining with diachronous facies boundaries sloping upwards towards the offshore end and towards the axis of the body. (Humphreys-ISWS)
W80-05146

LOCAL AND SHOALED COMPARISONS OF SEA SURFACE ELEVATIONS, PRESSURES, AND VELOCITIES,
Scripps Institution of Oceanography, La Jolla, CA. Shore Processes Lab.
R. T. Guza, and E. B. Thornton.
Journal of Geophysical Research, Vol 85, No C3, p 1524-1530, March 20, 1980. 10 Fig, 3 Tab, 17 Ref. ONR NR388-114, N000014-75-C-0300.

Descriptors: *Waves(Water), *Ocean waves, *Beaches, *Surf, Coasts, Shores, On-site investigations, Measurement, Pressure, Velocity, Water levels, Data processing, Analytical techniques, Theoretical analysis, Wave spectra, Shoaling.

Sea surface elevations, or pressures, and velocities were measured at closely spaced (wavelength or less) locations in a line extending from 10-m depth to inside the surf zone at Torrey Pines Beach, San Diego, California. Intercomparisons of local pressure, velocity, and sea surface elevation spectra for the wind wave frequencies (0.05-0.3 Hz) were made by using linear wave theory. Errors in both total variance and energy density in a particular frequency band were less than 20% both inside and outside the surf zone, except in the immediate vicinity of the breakpoint, where larger disparities were observed. Surface elevation spectra calculated at 10 m were shoaled by using linear wave theory. The total variance of stations between 10- and 3-m depth were typically predicted with less than 20% error, although harmonic amplification and other nonlinear effects can lead to significant errors in the prediction at particular frequency bands. Observations inside 3-m depth significantly departed from the predictions of linear shoaling theory. (Sims-ISWS)
W80-05150

TEMPORAL AND SPATIAL VARIABILITY IN LONGSHORE MOTION ALONG THE TEXAS GULF COAST,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
N. P. Smith.
Journal of Geophysical Research, Vol 85, No C3, p 1531-1536, March 20, 1980. 6 Fig, 2 Tab, 15 Ref. BLM AA550-CT7-11.

Descriptors: *Currents(Water), *Coasts, *Texas, *Gulf of Mexico, *Variability, On-site investigations, Ocean currents, Current meters, Measurement, Temporal distribution, Spatial distribution, Data processing, Water circulation, Oceans, Oceanography, Longshore motion, Texas Gulf Coast.

Recording current meter data from a 43-day period in the summer of 1977 were used to investigate longshore coherence at three study sites along the central and lower Texas coast in the northwestern Gulf of Mexico. Mid-depth current data from inner shelf waters revealed an alternating longshore motion that is coherent with the longshore component of the wind stress. Current reversals occured over time scales of the order of 1-2 weeks, but there was a net displacement into the north-northeasterly quadrant at all three locations. Transient periods of convergence and divergence were suggested between adjacent study sites as a result of not quite simultaneous reversals in longshore motion, or gradients in longshore motion in the same sense. Spectral analysis of the longshore current components indicated that motion is very nearly in phase along this part of the coast and that the flow is highly coherent over time scales in excess of about 3 days. (Sims-ISWS)
W80-05151

VERIFICATION OF A STORM TIDE MODEL FOR BOSTON,
Harris (Frederic R.), Inc., New York.
M. J. McCarthy, E. J. Schmeltz, and R. G. Dean.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 172-188, 1978. 24 Fig, 11 Ref.

Descriptors: *Tides, *Model studies, *Storms, *Harbors, *Massachusetts, Floods, Tidal effects, Tidal waters, Calibrations, Hurricanes, Analytical techniques, Storm surge, On-site investigations, Analysis, Methodology.

This paper deals with the verification of a numerical winter storm surge model. The coastal areas for which flood elevations were determined include the northern portion of Boston Harbor extending into the Mystic, Charles, and Chelsea Rivers to the upstream limits of tidal flow. Much of the coastline in the study area is bordered by piers and wharves with an average elevation 10 feet above mean sea level (MSL). The coastline of South Boston bordering Dorchester Bay consists mainly of beaches which slope steeply upward to approximately 10 feet above MSL. The major storms affecting the study area are winter storms commonly known as Northeasters. The numerical model developed to calculate winter storm surges was found to agree well with observed water levels for the various winter storms studied. The Bathystrophic assumptions made in order to limit computing time and expense did not significantly affect the calculated water levels. These assumptions were possible due to the extremely large size of the winter storms in the Boston area and the predominance of these storms in the determination of maximum storm tide levels. The assumption of an elliptical pressure field was also shown to reflect accurately the observed winter storm pressure fields studied. (See also W80-05159) (Humphreys-ISWS)
W80-05173

GROUNDWATER SIMULATION FOR KOEBERG POWER STATION,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Hydraulic Engineering.
D. Stephenson.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 197-205, 1978. 3 Fig, 5 Ref.

Descriptors: *Groundwater, *Model studies, *Saline water intrusion, *Hydrogeology, Coasts, Mathematical models, Foreign research, Groundwater movement, Aquifers, Transmissivity, Storage coefficient, Calibrations, On-site investigations, *South Africa.

The Koeberg Nuclear Power Station in South Africa is under construction. The foundations of the station are below sea level and there is a possibility of seawater corroding the sand-cement concrete raft unless the seawater/fresh water interface is controlled and the depression in the water table, caused by dewatering, is replenished with fresh water. A computer program was developed to simulate the water table fluctuations and groundwater flow in the vicinity of the foundations. Pumping tests were performed to determine the geohydrological coefficients. Fissures in the bedrock caused inflows not predicted by the computer model until the geohydrological coefficients were suitably adjusted. The model successfully predicted the seawater encroachment into the foundation area of the power station during dewatering. It was further predicted that once foundation construction was complete and the water table permitted to revert to normal, saline water would be drawn into the cutoff area. Replenishment with fresh water within the cutoff area instead of saline water would be a solution. The model could also be used to simulate the flow and dispersion of contaminated water if there were a leak from the station. (See also W80-05159) (Humphreys-ISWS)
W80-05174

THE OPTIMIZATION OF PUMPING OPERATIONS IN THE EL SOCORRO AQUIFER BY MATHEMATICAL MODELLING,
National Water Authority of Jamaica (West Indies).
For primary bibliographic entry see Field 2F.
W80-05176

COMPARISON OF VERIFIED PHYSICAL AND MATHEMATICAL MODEL,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
C. Y. Kuo, and C. H. Blair.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of

the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 222-229, 1978. 6 Fig, 6 Ref.

Descriptors: *Estuaries, *Model studies, *Tides, *Virginia, Calibrations, Water levels, Tidal effects, Hydraulic models, Mathematical models, Currents(Water), Salinity, Water quality, Analysis, *Lafayette River(VA), *Norfolk(VA), Model verification.

A physical model and a mathematical model have been used to study the Lafayette River, a small well-mixed estuary in Norfolk, Virginia. The studies include the tide heights, currents, salinity distributions, and mass transport. Both types of model were verified. Results from physical and mathematical models were compared. The physical model is a Froude model having horizontal scale of 1:540 and vertical scale of 1:12. Adjustment by roughness strips produced close agreement of physical model-prototype tide heights, currents, and salinity. An existing one-dimensional network mathematical model of LaGrangian formulation, developed by Brandsma, Lee, and Bowerman, was modified to predict hydrographic information and dispersion of mass in the Lafayette River. The tidal heights, currents, and salinity distribution in the physical model were calibrated against the prototype data. The objective was to achieve the best overall agreement in adjustments for all three quantities at all stations with a reasonable degree of accuracy. The three quantities in the physical model compared favorably with those in the prototype. The mathematical model simulated the desired tidal heights and current velocities quite well. The conjunctive use of the physical and mathematical models provides a useful tool to check each other and therefore increases the confidence level of the modeling techniques. (See also W74-05698 and W80-05159) (Humphreys-ISWS)
W80-05177

A DYNAMIC ESTUARY MODEL OF CHARLESTON HARBOR,
CH2M/Hill, Reston, VA.
M. G. Taylor, R. S. Taylor, and M. R. Stansbury.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 230-236, 1978. 1 Ref.

Descriptors: *Harbors, *Hydraulics, *Water quality, *Model studies, Mathematical models, Estuaries, Rivers, Flow, Streamflow, Pollutants, Path of pollutants, Rainfall, Winds, Evaporation, Sampling, Data processing, Calibrations, *Charleston Harbor(SC).

The Dynamic Estuary Model (DEM) was modified for application to the Charleston Harbor, South Carolina. A network of 17 tide gages provided the historical record for calibration and verification of the hydrodynamic portion of the model for the three main branches of the estuary, the Cooper, Wando, and Ashley rivers. Modifications to the model allowed acceptance of historical boundary tide elevation inputs and stage dependent channel roughness coefficients. System response to large diurnal fluctuations in Pinopolis Dam freshwater releases from Lake Moultrie at the head of the Cooper River verified the use of hydrograph inputs to the model. A water quality sampling program conducted in short, intensive periods over a 14-day period at 20 sites provided the data base for calibration of the water quality portion of the model. Conductivity measurements, in the absence of flow measurements, provided additional verification of the hydraulics calibration of the rivers. The model was used to analyze the impact of rediversion of freshwater from Lake Moultrie to the Santee River and for evaluating alternative water quality management planning strategies developed in the 208 areawide wastewater management plan being done by the Berkeley-Charleston-Dorchester Council of Governments. (See also W80-05159) (Sims-ISWS)
W80-05178

VERIFICATION OF AN ESTUARINE MODEL FOR APALACHICOLA BAY, FLORIDA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
D. S. Graham, J. M. Hill, and B. A. Christensen.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 237-245, 1978. 8 Fig, 7 Ref. NOAA 04-7-158-44046.

Descriptors: *Estuaries, *Water quality, *Model studies, *Remote sensing, *Florida, Satellites(Artificial), Mathematical models, Calibrations, Turbidity, Hydrogen ion concentration, Suspended solids, Dissolved oxygen, Water pollution, Color, Rivers, Coasts, Tidal waters, *Apalachicola Bay(FL).

The water quality management process in Florida requires analysis of the effects of basin activities and associated point and nonpoint effluents upon its important coastal zone. Determination of the effects of nonpoint source pollution from agricultural and silvicultural activites, as required by Section 208(I) of the Federal Water-Quality Act of 1972 Amendments, has proved to be particularly difficult. A current research project at the Hydraulic Laboratory of the University of Florida involves linking appropriate currently available basin runoff and estuarine models to quantitatively predict the transient effects of runoff emanating from upland basin activities, particularly forestry practices, upon the biology and water quality of Apalachicola Bay, FL. A cooperative project with the EPA Remote Sensing Laboratory in Las Vegas provided several Landsat images of both Apalachicola Bay and the Tate's Hell Swamp area. Special analyses of spectral signatures allowed differences in surface water color and turbidity to be highlighted, and a set of images was produced in which characteristic circulation patterns may be distinguished. Examination of properly processed Landsat images can allow stationary sampling stations to be advantageously placed, and provides great ability to correctly extrapolate data spatially from a few sampling stations. The data so gathered and estimated are instantaneous and therefore amenable to verification of so-called real-time water quality and hydrodynamic numerical models. (See also W80-05159) (Sims-ISWS)
W80-05179

VERIFICATION OF A YORK RIVER ECOSYSTEM MODEL,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5C.
W80-05180

MATHEMATICAL MODELING OF SEDIMENT AND CONTAMINANT TRANSPORT IN THE JAMES RIVER ESTUARY,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2J.
W80-05185

A MATHEMATICAL MODEL FOR WATER QUALITY ANALYSIS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5B.
W80-05190

VERIFICATION OF FINITE ELEMENT HYDRODYNAMIC MODEL CAFE,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. D. Wang.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 500-508, 1978. 5 Fig, 2 Ref.

Descriptors: *Bays, *Estuaries, *Water circulation, *Hydrodynamics, *Model studies, Mathematical models, Finite element analysis, Shallow water, Coasts, Circulation, Currents(Water), Tidal waters, Tides, Tidal effects, Boundary processes, *Biscayne Bay(FL).

In recent years the adaptation of numerical models to predict the tidal hydraulics of coastal embayments and estuaries has become an important tool in environmental studies. For shallow water bodies the two-dimensional vertically integrated or averaged models are the most widely used. Early finite difference models suffer from difficulties in treating complicated boundaries properly; however, several new techniques have been introduced to overcome these problems and to allow for a variable grid network. The Circulation Analysis with Finite Elements model (CAFE) represents one of these newer developments. Although these models aid in the qualitative understanding of fundamental physical processes, their primary purpose is to provide quantitative data. Confidence in the performance of these models under varying conditions as well as user proficiency must be established through verification. This paper described the field comparison for CAFE in South Biscayne Bay, Florida. Similar bays are found throughout southern Florida and along the Gulf coast. Although put to a severe test, since no adjustments were attempted, the hydrodynamic model, CAFE, gave a reasonable prediction of overall flow patterns in Biscayne Bay. The model, therefore, seems to describe correctly the principal physical processes. The main obstacles in obtaining accurate quantitative results lie in correct schematization and prescription of boundary conditions. (See also W80-05159) (Sims-ISWS)
W80-05202

VERIFICATION OF A NUMERICAL FLOW MODEL FOR CAROLINA BEACH INLET, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Center for Marine and Coastal Studies.
T. C. Gopalakrishnan, and J. L. Machemehl.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 509-517, 1978. 6 Fig, 5 Ref. NOAA 04-6-158-44054.

Descriptors: *Inlets(Waterways), *Currents(Water), *Water circulation, *Model studies, *North Carolina, Mathematical models, Circulation, Velocity, Tidal waters, Tides, Tidal effects, Flow, Analytical techniques, Finite element analysis, Estuaries, Coasts, *Carolina Beach Inlet(NC).

The numerical flow model developed by Machemehl and Gopalakrishnan for computation of flow in tidal inlets with junctions has been applied to Carolina Beach Inlet, North Carolina. The model couples the Galerkin Technique with a finite element analysis. The vertically integrated equations of momentum and mass conservation were used with appropriate boundary and initial conditions. The junction conditions were introduced by the time rates of change of energy and mass flux at the junction. A 'double sweep' approach was used in solving for the dynamics of flow. The method has several advantages in that the coefficient matrix in the solution system does not change as the model is stepped ahead in time. The Galerkin finite element model for flow in an inlet was found satisfactory considering the complex nature of the flow in a tidal inlet. (See also W80-05159) (Sims-ISWS)
W80-05203

TIDAL CIRCULATION IN COASTAL SEAS,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
C. H. Beauchamp, and M. L. Spaulding.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 518-528, 1978. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Bays, *Tidal waters, *Water circulation, *Tides, *Model studies, *New England, Mathematical models, On-site data collections, Circulation, Tidal effects, Winds, Bathymetry, Currents(Water), Velocity, Coasts, Estuaries.

An application of Leendertse's multioperational finite difference scheme for solution to the two-dimensional, vertically integrated momentum and continuity equations has been made for tidal circulation in Long Island Sound, Block Island Sound, Rhode Island Sound, and Buzzards Bay (referred to as the Southern New England Intracoastal System). The circulation within the modeled region is predominantly forced by specification of tidal elevation along the large open boundary separating the system from New England shelf waters. No direct measurements of tidal elevation along this boundary exist, however, and an attempt to estimate this boundary condition has been made using range and phase at stations on the coast and limited tidal information for the shelf in the vicinity of the open boundary. The model was calibrated by comparing phase and range of tidal elevations obtained from the simulations with those measured at 46 locations within the modeled region. An optimal matching was accomplished by adjustment of bottom friction. Further comparison has been conducted using tidal current observations from several stations in Rhode Island Sound and a set of approximately 160 stations in Long Island and Block Island Sound. (See also W80-05159) (Sims-ISWS)
W80-05204

VERIFICATION OF FIXED-BED ESTUARINE MODELS,
Army Engineers Waterways Experiment Station, Vicksburg, MS.
M. J. Trawle, and R. F. Athow, Jr.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 583-590, 1978.

Descriptors: *Hydraulic models, *Estuaries, *Model studies, *Tidal waters, Currents(Water), Tidal effects, Shoals, Flow, Salinity, Calibrations, Fixed bed models, Model verification.

A fixed-bed estuarine model is a physical, hydraulic model of an estuary, molded in concrete, and scaled according to Froudian law. This type model is usually distorted. A typical scale is 1000 to 1 (prototype to model) horizontally, and 100 to 1 (prototype to model) vertically, resulting in a distortion ratio of 10 to 1. Fixed-bed estuarine models are designed to reproduce prototype water surface elevations, tidal currents, and salinities throughout the modeled area. Additionally, in such models design consideration is given to the reproduction of prototype sediment distribution within a portion of the modeled area. The worth of any model, physical or otherwise, is wholly dependent on the verification of the ability to produce within a reasonable degree of accuracy results which can be expected to occur in the prototype under given conditions. Verification of a fixed-bed estuarine model is generally accomplished in three phases: (1) hydraulic verification, which ensures that tidal elevations and phasing and current velocities and directions are in proper agreement with the prototype; (2) salinity verification, which ensures that salinity phenomena in the model correspond to those of the prototype for similar conditions of tide, ocean salinity, and freshwater inflow; and (3) fixed-bed sediment distribution verification, which assures acceptable reproduction of prototype sediment distribution. (See also W80-05159) (Humphreys-ISWS)
W80-05211

FIELD VERIFICATION OF SEDIMENT TRANSPORT MODEL,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
T. T. Chang, and Y. H. Wang.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 737-744, 1978. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *On-site tests, *Sediment transport, *Model studies, *Coasts, Sediments, Movement, Littoral drift, Sands, Tracers, Methodology, Analysis, Analytical techniques, Mathematical models, Statistical methods, Model verification.

The purpose of this study was twofold: to investigate the sand transport rate under the wave and current action of the bayshore of a barrier island and to determine how different grain sizes and tracer injection positions affect the sand transportation rate. The sand-tracing method is used for determining the littoral transport rate. The data were analyzed by statistical methods. The effect of grain size on the sediment transport rate at different injection positions was analyzed by equating the grain size to the proportionality coefficient at different injection positions. The K' values were tested by the analysis of variance. It was concluded: (1) In this experiment the proportionality coefficient is not significantly influenced by the injection position and the grain size. The mathematical model has verified that the relationship between the immersed weight transport rate and wave and current parameters is linear. (2) The proportionality coefficient between the longshore transport rate and the wave and current parameters was determined by regression analysis. A regression line forcing through the origin incorporates most of the data points within the 95% confidence limits and accounts for 94% of the variation. (3) The proportional coefficient, K' = 0.18, on the bayshore of Santa Rosa barrier island is different from that derived by Komar. This difference may have resulted from the dissimilar transporting characteristics. On the bayside, wind may have played a noticeable role, while on the open coast the oblique breaking waves are prominent. (See also W80-05159) (Humphreys-ISWS)
W80-05228

TWO-DIMENSIONAL TIDALLY AVERAGED ESTUARINE MODEL,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
W-S. Chu, and W. W-G. Yeh.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY4, Proceedings Paper 15345, p 501-518, April 1980. 8 Fig, 25 Ref, 2 Append. OWRT B-191-CAL(2).

Descriptors: *Estuaries, *Model studies, *Tidal waters, *Dispersion, Mathematical models, Salinity, Tidal energy, Average, Numerical analysis, Water quality, Hydrodynamics, Analytical techniques, Equations, Tidal effects, Hydraulics, Two dimensional model.

Two types of models have been used extensively in the studies of estuaries: (1) physical hydraulic models and (2) numerical models. This study deals with vertically averaged two-dimensional numerical models for estuarine hydrodynamics and salinity. The governing equations are the hydrodynamics equations coupled with the transport equation. The effect of the density gradient was included in the model which requires simultaneous solutions for all variables. The tidally averaged solutions and the associated numerical scheme were verified by solutions obtained from a corresponding transient model where long term integration was performed to reach a dynamic steady-state condition. The proposed model can be utilized to: (1) obtain dynamic steady-state solutions directly without performing long term integrations over time; and (2) serve as an efficient forward solution scheme for parameter identification, since parameters imbedded in the governing equations, such as the roughness coefficients, are essentially time-invariant. The tidally averaged model was derived under the assumption that amplitudes of the transient variables are small in magnitudes. (Humphreys-ISWS)
W80-05251

THE OCCURRENCE OF BRYOPHYTES ON BRITISH SALTMARSHES,
Cambridge Univ. (England). Botany School.
For primary bibliographic entry see Field 2I.
W80-05308

FUNGI ASSOCIATED WITH THE ROOTS OF RED MANGROVE, RHIZOPHORA MANGLE,
Hawaii Univ., Honolulu. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-05312

AIRBORNE MULTISPECTRAL SURVEY OF INTERTIDAL VEGETATION IN ALASKA,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 2I.
W80-05313

VEGETATIONAL DEVELOPMENT AND THE EFFECT OF GEESE ON VEGETATION AT LA PEROUSE BAY, MANITOBA,
Toronto Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-05317

BIOGENIC SEDIMENTARY STRUCTURES PRODUCED BY CRABS IN LAGOON MARGIN AND SALT MARSH ENVIRONMENTS NEAR BEAUFORT, NORTH CAROLINA,
Mount Holyoke Coll., South Hadley, MA. Dept. of Geology.
For primary bibliographic entry see Field 2I.
W80-05320

EXPERIMENTAL DEGRADATION OF DETRITUS MADE FROM THE SALT MARSH PLANTS SPARTINA ALTERNIFLORA LOISEL., SALICORNIA VIRGINICA L., AND JUNCUS ROEMERIANUS SCHEELE,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W80-05321

ACCUMULATION OF TIN BY MANGROVE SPECIES IN WEST MALAYSIA,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
For primary bibliographic entry see Field 2I.
W80-05325

ENVIRONMENTAL FACTORS IN RELATION TO THE SALT CONTENT OF SALICORNIA PACIFICA VAR. UTAHENSIS,
Brigham Young Univ., Provo, UT. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-05327

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

REVERSE OSMOSIS TECHNICAL MANUAL.
Burns and Roe Industrial Services Corp., Paramus, NJ.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-186950, Price codes: A13 in paper copy, A01 in microfiche. Final Report OWRT TT/80 2 Prepared for the Office of Water Research and Technology, July 1979. 286 p. OWRT C-80155-S (No 8530)(1), 14-34-0001-8530.

Descriptors: *Reverse osmosis, *Semi-permeable membranes, *Membrane systems, Feedwater pretreatment, Salt rejection, Desalination, Seawater, Brackish water, Dissolved solids rejection.

A comprehensive design manual was compiled for reverse osmosis systems suitable for use by consulting engineers and others actively involved in water supply and improvement for municipal water systems. The manual includes chapters on semipermeable membranes, membrane module configurations, feedwater treatment, dissolved solids rejections, membrane productivity, systems design, system installation and operation, membrane applications, selected capital and annual costs and specifications and warranties. Appendices include miles-

tones in development of reverse osmosis, directory of manufacturers, water quality standards, performance calculations, glossary of terms, conversion tables and miscellaneous figures and tables. (Easton-OWRT)
W80-05155

3F. Conservation In Agriculture

IRRIGATION MANAGEMENT -- A MECHANISM FOR SAVING ENERGY AND WATER,
Nebraska Univ., Lincoln, Dept. of Agricultural Engineering.
P. Fischbach.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190614, Price codes: A09 in paper copy, A01 in microfiche. Project Completion Report, May 1980. 188 p. OWRT B-033-NEB(1), 14-31-0001-5137.

Descriptors: *Irrigation design, *Water conservation, *Energy conservation, *Irrigation efficiency, *Agriculture, Water management(Applied), Irrigation systems, Furrow systems, Water requirements, Nebraska.

Research was conducted to determine irrigation management practices on the various soil textures in Nebraska. The basic objective was to design and select irrigation systems to minimize water and energy requirements. To meet this objective, improved irrigation practices were investigated for more efficient use of water and energy resources. Research has indicated that irrigating at maximum non-erosive stream size and automating the furrow irrigation system, one can reduce the irrigation set time and amount of water applied to acceptable levels. This design criteria substantially increases the efficiency of water and energy used. Research has also shown that the selection of various furrow opening and furrow smoothing practices influences the amount of water applied and should be selected according to the soils infiltration characteristics. Applying a maximum two-inch application of water is recommended during the first irrigation and up to a three-inch application for subsequent irrigations. Research indicates that various irrigation scheduling methods may be used to make efficient use of water and energy which may improve these practices. A state-wide program of technology transfer by the Cooperative Extension Service was developed to disseminate research results to farmers, agricultural consultants and other groups who may make immediate application of results.
W80-05249

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

AN INTERACTIVE SIMULATION OF PUMPED STORAGE RESERVOIR SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. F. Calhoun, E. F. Benfield, and D. N. Contractor.
Water Resources Bulletin, Vol 16, No 1, p 63-68, February 1980. 7 Fig, 14 Ref.

Descriptors: *Reservoirs, *Pumped storage, *Water temperature, *Model studies, Mathematical models, Computer models, Simulation analysis, Powerplants, Electric powerplants, Rivers, Temperature, Computer programs, Evaluation.

A combination pumped storage reservoir system was simulated by modifying the WRE deep reservoir model. Each of the two reservoirs was described by a copy of the WRE model program, the two programs were converted into subroutines and were called upon alternately by a main program. Operationally, the contributing reservoir, i.e., the reservoir from which flow was discharged, was simulated for one execution interval (1 hour), followed by simulating the receiving reservoir for the same execution interval. The main program directed the discharge temperature of the contributing reservoir for each execution interval as input for simulating the receiving reservoir. The two subroutines were run in this interactive mode for a simulation period of one year. Two simulations, labeled 'Pump' and 'Net', were effected and differed basically in the distribution of flow volumes exchanged between the reservoirs. In the 'Pump' simulation the total hourly flow volumes were distributed into appropriate horizontal layers of the lakes as determined by temperature-density relationships, i.e., the pumped discharges were distributed into the upper lake and the generation discharges were distributed into the lower lake. In the 'Net' simulation only the net daily discharges (daily difference between pump-back and generation at the upper dam), distributed uniformly over 24 hours, were mixed into the horizontal layers of the two lakes. Both simulations produced annual thermal regimes that were apparently within reason for the geographical area and the nature of the input data. However, neither accurately reflected a generalized condition for the reservoirs because the 'Pump' simulation reflected conditions in the forebay and tailrace of the Upper dam while the 'Net' simulation reflected conditions of the remaining parts of the reservoirs. (Sims-ISWS)
W80-05142

CONTROL OF UNSTEADY FREE-SURFACE FLOW WITH GATES,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-05232

RUNOFF SIMULATION MODEL: APPLICATION AND VERIFICATION,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 2A.
W80-05240

COMPARISON OF STORMWATER DETENTION POLICIES,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-05241

A DIGITAL OVERLAY TECHNIQUE FOR EVALUATION OF POTENTIAL INFILTRATION AND RECHARGE,
University of South Florida, Tampa. Coll. of Engineering.
M. W. Anderson, and R. F. Giovannelli.
Water Resources Bulletin, Vol 16, No 1, p 93-99, February 1980. 5 Fig, 1 Tab, 2 Ref.

Descriptors: *Groundwater recharge, *Infiltration, *Mapping, *Land use, *Planning, *Florida, Computer models, Equations, Land development, Runoff, Soil types, Water levels, Water table, Potentiometric level, Hydraulic properties, Overlay mapping.

A common problem encountered during regional planning and development of groundwater dependent communities is the difficulty in deciding which areas should be preserved for aquifer recharge purposes. This paper described the development and application of a digital overlay technique for objective evaluation and ranking of potential infiltration and potential recharge areas. Equations were developed which relate the hydrologic parameters pertaining to infiltration and recharge in a surface aquifer-confined aquifer system. These equations make use of discrete data, yet by application in a digital overlay technique results are obtained in the form of spatial distributions in order for regional trends and conditions to be examined. An application of this procedure to the 551,000 acre region of central Florida, known as the Green Swamp, was discussed. The results were presented in the form of computer-generated maps which identify and rank areas of potential recharge to the aquifer system. (Visocky-ISWS)
W80-05261

4B. Groundwater Management

THE ECONOMIC CONSEQUENCES OF IRRIGATING CORN ON FINE TEXTURED SOILS IN THE HUMID MIDWEST,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W80-05102

A PLAN TO STUDY THE AQUIFER SYSTEM OF THE CENTRAL VALLEY OF CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-05296

CONTRIBUTION OF GROUNDWATER MODELING TO PLANNING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-05300

MANAGING A LIMITED RESOURCE: THE POLITICAL CONSTRAINTS ON WATER POLICY IN THE FOUR-CORNERS STATES,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 6E.
W80-05370

GEOTHERMAL DEVELOPMENT AND WESTERN WATER LAW,
O'Melveny and Myers, Los Angeles, CA.
For primary bibliographic entry see Field 6E.
W80-05372

4C. Effects On Water Of Man's Non-Water Activities

AN OPTIMIZATION TECHNIQUE FOR A MATHEMATICAL URBAN RUNOFF MODEL,
Howard, Needles, Tammen and Bergendoff, Minneapolis, MN.
C. S. Chu, and C. E. Bowers.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 120-128, 1978. 7 Fig, 1 Tab, 16 Ref, 1 Append.

Descriptors: *Optimization, *Model studies, *Urban runoff, Urban hydrology, Mathematical models, Analytical techniques, Infiltration, Hydrographs, Mathematical studies, Computer models.

The purpose of the study was to develop a simple mathematical urban runoff model and, along with it, an automatic optimization technique. The optimization technique can assist the user in determining the 'best' set of input parameters to reproduce an observed hydrograph. A modified Holtan's infiltration equation based on soil moisture content was used to compute the infiltration rate. A simple Soil Conservation Service triangular unit hydrograph procedure was used to obtain the runoff hydrograph. A routing procedure has not, as yet, been included in the model. Seven available optimization techniques were tested in order to select the best optimization technique for the model. It was found that the BOX-COMPLEX method produced consistently good results for five randomly chosen initial starting points. Other 'Gradient' methods did not perform as well. Improvement of BOX-COMPLEX method was attempted by (1) changing the values of coefficients and the number of operations and (2) by adding expansion and shrinkage operations. It was found that the two basic operations, reflection and contraction, with proper coefficient values not only produced good results but also retained the simple structure of the

BOX-COMPLEX method. The reflection and contraction coefficients were 2.0 and 0.5, respectively. The model was applied to the Oakdale Avenue Drainage Basins in Chicago. The agreement between the observed and the calculated hydrographs achieved by the proposed model, for a storm of July 2, 1960, was excellent in both timing and magnitude of the peak flow. (See also W80-05159) (Humphreys-ISWS)
W80-05169

RECONNAISSANCE ASSESSMENT OF EROSION AND SEDIMENTATION IN THE CANADA DE LOS ALAMOS BASIN, LOS ANGELES AND VENTURA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W80-05305

STOCHASTIC ANALYSIS OF ANNUAL RAINFALL AFFECTED BY URBANIZATION,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 2B.
W80-05331

SURFACE MINING AND THE HYDROLOGIC BALANCE,
Northeastern Forest Experiment Station, Berea, KY.
W. R. Curtis.
Mining Congress Journal, p 35-40, July 1979. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Hydrology, *Strip mines, *Peak flow, *Sedimentation, *Erosion, Effects, Storm runoff, Land reclamation, Flow rates, Kentucky, West Virginia, Eastern Kentucky, Southern West Virginia.

Research by the U. S. Forest Service at Berea, Kentucky, has shown that surface mining results in increases in storm peak flows during and immediately after mining, but that peaks may be significantly lower after reclamation is completed. Data from experimental sites in Breathitt County, Kentucky, and Raleigh County, West Virginia, during major rainstorms on 4 April 1977 and 8, 9, and 10 December 1978 showed that streamflow from surface-mined watersheds peaked lower than that from adjacent or nearby unmined watersheds. Impoundments on surface-mine lands can be effective in controlling runoff and erosion provided the ponds are properly constructed. Erosion and subsequent sedimentation are greatest during early stages of mining but diminish rapidly as the land is reclaimed and vegetation growth progresses.
W80-05334

THE URBAN COAST FROM A NATIONAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-05363

THE LOST WATERFRONT OF NEW YORK,
New York Univ., NY. Graduate School of Public Administration.
For primary bibliographic entry see Field 6E.
W80-05364

ENERGY FACILITY SITING IN THE URBAN COASTAL ZONE: COMPATIBLE OR NOT,
Princeton Univ., NJ.
For primary bibliographic entry see Field 6E.
W80-05365

COASTAL ZONE MANAGEMENT: THE FIRST FIVE YEARS AND BEYOND,
National Oceanic and Atmospheric Administration, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05366

A PETROLEUM INDUSTRY PERSPECTIVE ON FEDERAL COASTAL ZONE MANAGEMENT,
American Petroleum Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05367

UNRESOLVED ISSUES OF COASTAL ZONE MANAGEMENT,
Rose, Schmidt, Dixon, Hasley, Whyte and Hardesty, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05368

COASTAL LAND MANAGEMENT IN CALIFORNIA,
Houston Univ., TX.
For primary bibliographic entry see Field 6E.
W80-05378

4D. Watershed Protection

ESTIMATING THE C FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION FOR LANDSCAPED SLOPES,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W80-05147

ESTIMATING THE C FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION FOR LANDSCAPED SLOPES: A FIELD RATING SYSTEM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 2J.
W80-05148

HYDROSEEDING FOREST ROADSIDES IN BRITISH COLUMBIA FOR EROSION CONTROL,
British Columbia Univ., Vancouver. Dept. of Soil Science.
W. W. Carr, and T. M. Ballard.
Journal of Soil and Water Conservation, Vol 35, No 1, p 33-35, January-February 1980. 5 Tab, 9 Ref.

Descriptors: *Vegetation establishment, *Erosion control, *Road construction, *Slopes, On-site investigations, Grasses, Legumes, Forests, Roads, Erosion, Construction, Vegetation effects, Canada, British Columbia, *Hydroseeding.

Hydroseeding trials on forest roadside slopes at two Vancouver Island sites showed that a single application of both seed and fertilizer was as effective as sequential application of seed and fertilizer. Mulching proved unnecessary. Untreated plots had no plant cover. Soil eroded to an average depth of 2.3 centimeters between September 1976 and April 1977, an estimated soil loss of 345 cubic meters per kilometer of road. Plant cover on treated plots, which averaged 65%, trapped soil eroded from upslope. (Sims-ISWS)
W80-05149

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

REQUIREMENTS OF STATE REGULATORY AGENCIES FOR MONITORING GROUNDWATER QUALITY AT WASTE DISPOSAL SITES,
Minnesota Pollution Control Agency, Minneapolis.
T. P. Clark, and G. V. Sabel.
Ground Water, Vol 18, No 2, p 168-174, March-April 1980. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Groundwater, *Water quality, *Waste disposal, *Monitoring, Pollutants, Pollutant identification, Chemicals, Sampling, Surveys, Observation wells, Water pollution, Water pollution control, Law enforcement.

A survey of the requirements of State regulatory agencies responsible for monitoring groundwater quality at waste disposal sites was conducted in order to gain a concise profile of monitoring practices across the country, and also to provide the basis for a monitoring manual to serve as technical background and guidance for the citizens of Minnesota. The survey considered a variety of topics including the regulatory framework for requiring monitoring, chemical parameters analyzed, recommended methods of monitoring well construction and sample collection, laboratory quality control, data interpretation, and postoperational monitoring requirements. The survey showed that most State monitoring programs are in their infancy. Many States, however, are beginning to devote serious effort and manpower commitments to the development of monitoring programs, although there is considerable divergence of opinion regarding how these programs should be conducted. Federal legislation establishing minimum performance criteria instead of detailed operating requirements for waste disposal sites will increase the need for sound water monitoring programs at these sites in the future. (Sims-ISWS)
W80-05129

COMPARATIVE NUTRIENT DYNAMICS OF A MARSH-MUDFLAT ECOSYSTEM,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 5B.
W80-05131

WATER QUALITY TRAP EFFICIENCY OF STORM WATER MANAGEMENT BASINS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W80-05139

HYDROTHERMAL ANALYSES USING COMPUTER MODELING AND FIELD STUDIES,
Tennessee Valley Authority, Norris.
W. R. Waldrop.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 38-43, 1978. 3 Fig, 1 Ref.

Descriptors: *Hydrothermal studies, *Heated water, *Reservoirs, *On-site investigations, *Tennessee, Spatial distribution, Water temperature, Measurement, Model studies, Isotherms, Calibrations, Diffusion, On-site data collections, Analysis.

The procedures employed by TVA for obtaining field data, a brief discussion of the features of a three-dimensional finite-difference model used for simulations, and an example of model verification were presented. Results from the three-dimensional model were needed for an environmental evaluation of the submerged intake and surface discharge of condenser cooling water of the TVA Gallatin Steam Plant in central Tennessee. Prior to using the model to compute flow and temperature patterns under extreme conditions, the model was used to simulate a relatively high flow condition for which field data had been obtained. The comparison of measured and computed isotherms at a depth of 0.15 meters was presented. The results compare quite well in the main channel and are adequate in the shallow region near the right bank. Better agreement could have been achieved in this region by increasing the resolution, but the grid spacing was chosen such that three-fourths of the grid points were placed upstream of the discharge channel to evaluate flows and temperatures in environmentally sensitive areas during very low flows. (See also W80-05159) (Humphreys-ISWS)
W80-05161

MEASURING EFFLUENT PLUMES,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.

T. Green, J. A. Hoopes, F. L. Scarpace, J. R. Villemonte, and R. P. Madding.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 44-53, 1978. 1 Tab, 35 Ref.

Descriptors: *Lakes, *Rivers, *Effluents, *Wisconsin, On-site investigations, Water temperature, Turbidity, Spatial distribution, Heated water, Instrumentation, Sewage effluents, Industrial wastes, Remote sensing, Methodology, Reviews, Measurement, Plumes, Thermal plumes.

The University of Wisconsin at Madison has been measuring various aspects of effluent surface plumes into rivers, small lakes, and Great Lakes for over a decade. Some of this work has been aimed at developing measurement techniques, some at eliciting the fluid mechanics of the phenomenon, and some at formulating numerical models either generally applicable or directly applicable to the particular site. This paper is a review of the highlights of that work, together with a fairly complete list of references in which more details of the work can be found. The plumes studied were subdivided by the type of receiving water body, and according to whether the effluent is characterized mainly by its temperature (e.g., the discharged cooling water from a power plant) or by some other property (e.g., the effluent from a paper company). (See also W80-05159) (Humphreys-ISWS)
W80-05162

A THREE DIMENSIONAL THERMAL PLUME MODEL,
Cooper Union, New York.
J. C. Cataldo, R. R. Zavesky, and A. S. Goodman.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 54-60, 1978. 2 Fig, 4 Ref.

Descriptors: *Hydrothermal studies, *Reservoirs, *Isotherms, *Model studies, Mathematical models, Heated water, Forecasting, Spatial distribution, Discharge(Water), Water temperature, On-site investigations, Thermal plumes, Three-dimensional plume.

Presently, there are two techniques used to measure plume temperatures: (1) boats with in situ, temperature-sensing instrumentation, and (2) airborne, thermal, infrared, detection instrumentation. The aerial, infrared-monitoring offers a truly synoptic picture of the surface temperature, whereas the boat technique, because of the time needed for measurements, provides a time-distorted picture of the plume. A phenomenological model to predict both surface and subsurface temperatures from given discharge and receiving water characteristics was presented. The only parameters needed for the model are the plant discharge conditions and receiving water characteristics. The model, at this time, is restricted to surface discharges into zero or mild receiving water currents. The procedure may easily be extended to include receiving waters with strong cross-flows when sufficient triaxial, thermal-plume data become available to calibrate the model. A total of 19 triaxial field-surveys from five power plants were used to develop and calibrate the model. (See also W80-05159) (Humphreys-ISWS)
W80-05163

VERIFICATION OF AN ESTUARINE MODEL FOR APALACHICOLA BAY, FLORIDA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W80-05179

MODIFYING AUTOMATED PUMPING SAMPLERS FOR USE IN SMALL MOUNTAIN STREAMS,
Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta.
Water Resources Bulletin, Vol 16, No 1, p 137-138, February 1980. 2 Fig.

Descriptors: *Water quality, *Sampling, *Streams, *Equipment, *Oregon, Monitoring, Runoff, Streamflow, Pollutants, Water pollution, Mountains, Sampling equipment, Pumping samplers.

Two modifications to automated pumping samplers improve discrete sampling during high flow events in small mountain streams. One modification entails mounting the intake nozzle on a bent, free-swinging metal rod supported in midstream. This allows sampling in midstream yet prevents the buildup of floatable organic debris that otherwise would cause the intake to fail. On the lower end of the rod, dynamic forces exerted by the stream keep the intake submerged over diverse flow conditions. The second modification consists of a magnetic switching device that automatically activates the pumping sampler at any preset stage on the rising limb of a storm hydrograph. The pumping sampler then remains on to collect one sample per hour which allows field crews sufficient time to change bottles before the sampler fills its 28-bottle capacity. This device improves the capability to sample frequently at fixed intervals, yet with minimal maintenance between runoff events. It also ensures sample collection during the rising limb of the hydrograph when flow and sediment concentrations are rapidly changing. Both modifications have improved data collection during periods of storm runoff. (Sims-ISWS)
W80-05256

USING ARTIFICIAL STREAMS TO EVALUATE PERTURBATION EFFECTS ON AUFWUCHS STRUCTURE AND FUNCTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. R. Clark, J. H. Rodgers, Jr., K. L. Dickson, and J. Cairns, Jr.
Water Resources Bulletin, Vol 16, No 1, p 100-104, February 1980. 3 Fig, 1 Tab, 30 Ref. DOE E-(40-1)-4939.

Descriptors: *Periphyton, *Biological communities, *Streams, *Laboratory tests, Biomass, Water circulation, Velocity, Flow, Equipment, Facilities, Research facilities, Biology, Ecosystems, *Artificial streams, Perturbation effects.

Artificial streams can assist in assessing the potential impact of pollutants on the structure and function of aquatic communities. While most artificial streams are constructed within a controlled environment or are maintained by recirculating water, the authors constructed a series of artificial streams along a river bank using river water on a once-through basis. This system was used to develop and test methods for structural and functional analyses of Aufwuchs communities. Only the flow rate and stream depth were controlled while individual streams were perturbed to obtain communities of altered ecological condition. This experimental system provided a relatively inexpensive series of treated and untreated streams which allowed an evaluation and comparison of methods using communities under various stressed and nonstressed conditions. Without the stabilizing effects of a controlled atmosphere or recirculating water, the authors' approach demonstrated a degree of variability which approached that of the river. It was inferred that the Aufwuchs community present in the artificial streams maintained a high degree of structural complexity and functional dynamism, providing a strong test of the methods employed and an opportunity to examine current ecological theory. (Sims-ISWS)
W80-05260

COLIFORMS AND WATER QUALITY: USE OF DATA IN PROJECT DESIGN AND OPERATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W80-05262

CHLORINATED ORGANIC RESIDUES IN FISH, WATER, AND PRECIPITATION FROM THE VICINITY OF ISLE ROYALE, LAKE SUPERIOR,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
For primary bibliographic entry see Field 2H.
W80-05273

TRANSPLANTING AQUATIC BRYOPHYTES TO ASSESS RIVER POLLUTION,
University Coll., Cardiff (Wales). Dept. of Botany.
K. Benson-Evans, and P. F. Williams.
Journal of Brycology, Vol 9, p 81-91, 1976. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Rivers, *Mosses, *Water pollution, *Bioindicators, Vegetation effects, Environmental effects, Bioassay, Water pollution effects, Aquatic plants.

Literature dealing with the use of bryophytes for water quality assessment is briefly reviewed. Reasons are presented for the selection of the two bryophyte species, Eurhnchium riparioides and Fontinalis antipyretica, used in transplantation experiments. Results show that the breakdown of the two species, exposed on the river Ebbw Fawr, reflect improvements in water quality both downstream of the main source of pollution as a result of dilution and precipitation of pollutants, and over a period of four years as a result of improved effluent treatments. (Steiner-Mass)
W80-05311

ACCUMULATION OF TIN BY MANGROVE SPECIES IN WEST MALAYSIA,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
For primary bibliographic entry see Field 2I.
W80-05325

DATA PROCESSING AND ANALYSIS FROM H-F RADAR DATA OBTAINED IN COOK INLET ALASKA DURING SUMMERS 1977 AND 1978,
National Oceanic and Atmospheric Administration, Rockville, MD. Wave Propagation Lab.
D. E. Barrick, S. Frisch, and R. Weber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 1-4, 18-114, October 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Data processing, *Radar, *Currents(Water), Baseline studies, Environmental effects, Water pollution, Resources development, Movement, Path of pollutants, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

During the summer of 1977 the H-F Doppler surface current radar system was deployed in lower Cook Inlet, Alaska at Anchor Point and Seldovia. Several time series of data were collected during the deployment period. A representative 24-hour data set has been extensively analyzed. During the summer of 1978, a radar system was successfully operated in western lower Cook Inlet, Alaska, for a period of two weeks. About 8 days of data were collected at this time. The radar sites were located at Cape Douglas and Augustine Island for these experiments. These data have been processed and current vector maps have been plotted and included in this report. (Sinha-OEIS)
W80-05337

A NEW TECHNIQUE FOR MEASURING TIDAL CURRENTS USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Rockville, MD. Wave Propagation Lab.
A. S. Frisch, and B. L. Weber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 5-17, October 1979. 13 Ref. NOAA, Environmental Research Laboratories, Outer Con-

tinental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Tidal effects, *Radar, *Currents(Water), Offshore platforms, Water pollution effects, Resources development, Environmental effects, Alaska, Oil pollution, Movement, *Outer Continental Shelf, Tidal currents, Nearshore environment, Doppler radar, Gulf of Alaska, Petroleum development.

Surface currents were measured using a newly developed H-F (High Frequency) Doppler radar technique. The system was operated in lower Cook Inlet, Alaska in July, 1977. During one particular day the radar data collected every 30 minutes for 24 hours was analyzed. By least squares fitting these data to two of the dominate tidal periods, 12.31 and 24.6 hours, the spatial distribution of the tidal currents for each of these two periods were determined. In addition, the spatial distribution of the mean surface currents were determined for the 24 hour period. Analysis of the data shows that near Kachemak Bay, there is a distint difference of the east-west component of tidal flow compared to regions further from Kachemak. The results demonstrate the use of H-F radar techniques for resolving spatial and temporal currents which affect the nearshore environment. In those near-shore regions where the tidal currents dominate, the radar measurements, in conjunction with the tidal analysis, actually provides sub-surface currents which are important for stress considerations of off-shore oil platforms. (Sinha-OEIS)
W80-05338

THE INTERACTION OF OIL WITH SEA ICE IN THE ARCTIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.
S. Martin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 171-180, October 1979. 2 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-67.

Descriptors: *Sea ice, *Water pollution effects, *Oil spills, Movement, Environmental effects, Arctic Ocean, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, Petroleum development, Grease ice, Pancake ice.

To understand how spilled oil might interact with the various kinds of ice in the Beaufort, Bering and Chukchi Seas, field traverses were done in these regions with particular emphasis on ice types which have previously not been studied. These include grease and pancake ice in Norton and Kotzebue Sound, and most recently a field investigation of the ice plumes which form at the pack ice edge in the Bering Sea. In the laboratory experiments have been performed on how spilled oil interacts with grease ice, pancake ice, and simulated multi-year ice. (Sinha-OEIS)
W80-05340

DYNAMICS OF NEAR-SHORE ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. Kovacs, and W. Weeks.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 181-207, October 1979. 8 Fig, 3 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-1651.

Descriptors: *Sea ice, *Remote sensing, *Hazards, *Oil spills, *Movement, Engineering, Environmental effects, Baseline studies, Arctic Ocean, Water pollution, *Outer Continental Shelf, Fast ice, Petroleum development.

A knowledge of motion, deformation and physical characteristics of both the near-shore pack ice and the fast ice is essential to adequately designing and estimating the hazards associated with a variety of engineering options that may be considered for offshore operations in the near coastal areas of the Beaufort and Chukchi Seas. The present program contributes directly to the solution of this general class of engineering problems in that it will provide much of the geophysical and engineering data upon which sound engineering and regulatory decisions can be made. Interest in observing and developing methods to predict the drift of pack ice through the Bering Strait is linked to the fact that ice flow through the Straits would be a key mechanism in dispersing an oil spill occurring along the coastal areas of the Beaufort and Chukchi Seas. A remote sensing program provides basic information on the distribution of ice types and features and in particular ridges required as one aspect of a risk analysis for the construction of an offshore drilling platform sited on the edge of the Arctic Ocean. (Sinha-OEIS)
W80-05341

CURRENT MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Aagaard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 208-231, October 1979. 7 Fig, 5 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-67.

Descriptors: *Currents(Water), *Dispersion, *Water pollution, *Ocean circulation, Oil spills, Resources development, Environmental effects, Arctic Ocean, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The objective of this work has been to obtain long-term Eulerian time series of currents at selected locations on the outer shelf of the Beaufort Sea. Such measurements are necessary to describe and understand the circulation on the shelf and the exchange between the shelf and the deep Arctic Ocean. The significance of these results to the dispersion of plankton, pollutants, and substances of geological and biological consequence (below about 60 m) is as follows: (1) Material trajectories will nearly follow isobaths; (2) Over a period anywhere from 1-10 days, displacement may be either eastward or westward, and the magnitude of such displacement can exceed 40 km over 24 hours; (3) On time scales exceeding about one month, the net displacement will be westward, with mean speeds corresponding to typical monthly displacements in the range of 100-250 km; (4) Materials can also move on- and offshore on time scales of a few days. Such movements likely involve vertical displacements of several hundred meters; and (5) The shelf is an energetic and variable environment even in winter. (Sinha-OEIS)
W80-05342

NORTHWEST GULF OF ALASKA SHELF CIRCULATION,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. D. Muench, J. D. Schumacher, and R. Sillcox.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 232-248, October 1979. 8 Fig, 1 Tab, 14 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Currents(Water), *Dispersion, *Diffusion, Water pollution effects, Sediment transport, Oil spills, Baseline studies, Resources development, Alaska, Path of pollutants, Water circulation, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

The objective of this work is to relate oceanic advective and diffusive processes to potential pollution problems due to OCS petroleum development. This is accomplished through field activities including moored current measurements and water mass analysis using temperature and salinity observations. The regions being considered include the northwest Gulf of Alaska continental shelf west from about the longitude of Seward, Alaska to Unimak Pass and extends offshore to the outer boundary of the Alaskan Stream some 100 km off Kodiak Island. This study provides estimates of the fields of water motion which exert primary control over trajectories of spilled oil and over diffusion processes along the trajectories. Oil introduced into the environment via long-term or chronic leakage is more likely to be dispersed throughout the water column and, possibly, scavenged by suspended particulate matter. The problem then becomes one of understanding net transport of suspended matter, a process related to advective and diffusive fields within the water column. Understanding of these processes requires an analysis of the velocity field and its driving mechanisms. (Sinha-OEIS)
W80-05343

BRISTOL BAY OCEANOGRAPHIC PROCESSES (B-BOP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. L. Charnell, J. D. Schumacher, L. K. Coachman, and T. H. Kinder.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 249-319, October 1979. 27 Fig, 4 Tab, 40 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado

Descriptors: *Oceanography, *Currents(Water), *Tidal effects, *Hazards, Oil pollution, Baseline studies, Environmental effects, Water pollution effects, Alaska, Flow, *Outer Continental Shelf, *Bristol Bay(AK), Physical oceanography, Petroleum development.

The current reporting period covers the final experiments specifically conceived to address OCSEAP objectives in Bristol Bay and includes data analysis which will lead to the formulation of a comprehensive understanding of physical oceanographic processes occurring within Bristol Bay. Field efforts during this period were directed toward two objectives: the general nature of flow in Bristol Bay and detailed experiments of the dynamics to two structural fronts and their relation to: (1) the biology of the area and (2) an examination of the velocity field across and along the front. Analysis efforts have continued toward elucidating such phenomena as: fine structure, fronts, tides and tidal currents, eddy circulation off the shelf, and the mean and low frequency flow through the area. These efforts should lead to a reasonable synthesis of the regional physical oceanography, and its influence on the petroleum development hazard assessment. (Sinha-OEIS)
W80-05344

CIRCULATION AND WATER MASSES IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
T. C. Royer.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 320-383, October 1979. 19 Fig, 1 Tab, 2 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Oceanography, *Water circulation, *Paths of pollutants, *Oil spills, Environmental effects, Water pollution, Alaska, Resources development, *Outer Continental Shelf, *Gulf of Alaska, Water masses, Petroleum development.

Since the inception of the OCSEAP-NEGOA program, the knowledge of the physical oceanog-

raphy, in particular circulation and water masses, has evolved from the point where the annual cycle was marginally described to some of the physical mechanisms which control the annual cycle. The practical implications of this evolution in the case of OCSEAP is to better predict the shelf circulation and hence the possible trajectories that oil spills would follow. The improved understanding of the physical mechanisms which control the circulation allow predictions to be made from observational periods. The focus has been on mesoscale driving mechanisms in the past year's research. The mechanisms for driving the shelf circulation, such as wind stress, precipitation, runoff, and offshore circulation have been more clearly identified. This has lead to a detailed treatment of winds at Middleton Island and the hydrology for the southcoast region. Abstracts of papers submitted, presented or published are included in this report. (Sinha-OEIS)
W80-05345

NEAR-SHORE METEOROLOGY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. M. Reynolds, S. A. Macklin, and B. A. Walter.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 384-401, October 1979. 2 Fig, 2 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Weather patterns, *Winds, *Meteorology, Paths of pollutants, Oil pollution, Resources development, Water pollution, Baseline studies, Environmental effects, Alaska, *Outer Continental Shelf, Gulf of Alaska, Wind stress, Petroleum development.

The objective of this study is to define the dominant mesoscale features in four specific coastal regions, Albatross Banks, Kiliuda Bay, Lower Cook Inlet, and Hinchinbrook Entrance. A thorough knowledge of coastal wind conditions is an important ingredient to responsible offshore industrial development. Surface winds strongly affect both mean water circulations and the trajectories of surface contaminants. The work is aimed at defining which processes are active in modifying the wind field along the coast of Alaska, how prevalent they are, and how far offshore they act. All available meteorological data is utilized in developing as complete a description as possible for the four regions. The work is principally a comparison of the observed flow field and larger scale forcing, with some consideration to the energetics of the planetary boundary layer. Both ends of the spectrum are important in such a study due to the juxtaposition of different modifying processes. (Sinha-OEIS)
W80-05346

OBSERVATIONS OF MESOSCALE WINDS IN LOWER COOK INLET, ALASKA - MARCH 1978,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
S. A. Macklin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 402-433, October 1979. 11 Fig, 2 Tab, 17 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Winds, *Climatology, *Baseline studies, Environmental effects, Water pollution effects, Oil spills, Hazards, Alaska, Resources development, Paths of pollutants, *Outer Continental Shelf, Cook Inlet(AK), Petroleum development.

Surface wind data were collected and analyzed for the lower Cook Inlet region in March 1978. The dominant surface air circulation is due to pressure gradient forcing along two nearly orthogonal orographic channels. As much as 84% of surface air movement observed in lower Cook Inlet can be explained in terms of this flow. Additional mesoscale flows of katabatic and lee wave nature were identified at Kachemak Bay, Cape Douglas and Augustine Island. With the advent of oil exploration in lower Cook Inlet and the accompanying hazard of oil spills, knowledge of Cook Inlet air movement in response to large and small scale meteorological forcing is important. An accurate knowledge of coastal winds is also important in determining shallow water circulation in estuaries and on the continental shelf in charting the distribution of marine larval species and in providing accurate wind information to both aeronautical and marine navigators. (Sinha-OEIS)
W80-05347

THE RESPONSE OF COASTAL WINDS AT ALBATROSS BANKS, LOWER COOK INLET, AND HINCHINBROOK ENTRANCE TO A PASSING SYNOPTIC DISTURBANCE - PRELIMINARY ANALYSIS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
S. A. Macklin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 491-504, October 1979. 4 Fig. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Storms, *Winds, *Extratropical cyclones, *Oil spills, Hazards, Paths of pollutants, Resources development, Environmental effects, Water pollution, Alaska, Cook Inlet(AK), *Outer Continental Shelf, Weather conditions, Gulf of Alaska, Petroleum development.

This study relates coastal wind fields in three proposed oil lease and transport areas - lower Cook Inlet, Albatross Banks, and Hinchinbrook Entrance - to the passage of a typical extratropical cyclone. The possibility of inferring winds during an oil spill with such a synoptic scenario is investigated. Surface winds in these three coastal areas are explained in terms of synoptic characteristics of a mid-latitude cyclone. This storm influenced the study regions over the period 11 March to 13 March 1978 as it moved north out of the Pacific Ocean across the Aleutian Islands and into the Bering Sea. Maximum observed surface winds coincided with passage of an occluded front associated with the storm. Coastal winds in lower Cook Inlet and Hinchinbrook Entrance were dominated by orography. Winds over the Albatross Banks were observed to be a direct result of synoptic forcing alone. (Sinha-OEIS)
W80-05348

MODELING OF TIDES AND CIRCULATIONS OF THE BERING SEA,
Rand Corp., Santa Monica, CA.
J. J. Leendertse, and S. K. Liu.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 547-560, October 1979. 9 Fig, 2 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Model studies, *Currents(Water), *Tides, *Paths of pollutants, Oil spills, Water pollution effects, Environmental effects, Baseline studies, Alaska, Resources development, *Outer Continental Shelf, Bristol Bay(AK), Trajectory simulation.

Effort during this reporting period was to carry out modeling investigations for the Bristol Bay - St. George Basin area and for Norton Sound. The final prediction and verification run of the three-dimensional turbulent energy model was completed for the first study area. Bristol Bay is primarily a tide- and wind-driven system with distinctive nonhomogeneous hydrodynamic behavior. The three-dimensional model is required to characterize its response to these driving forces. The computed current field from predicted tides at the open boundary agrees very well with the observed values in the modeled area. Because of the sensitive interactions between density gradient, vertical shear structure and the vertical momentum exchange processes, it is very difficult to separate the wind and tide effects on the circulation. As a consequence, accuracy in tidal current prediction is a prerequisite in predicting surface drift and the pathways of pollutant discharges. For oil-spill trajectory simulation, extensive computation and graphic programs are under development. In order to provide wind input for the simulation, weather statistics from the Norton Sound area are being analyzed. A suitable method will be selected for generating random wind fields according to the local weather statistics. Trade-offs between several possible methods are being studied. (Sinha-OEIS)
W80-05350

COMPARISON BETWEEN GEOSTROPHIC WINDS DERIVED FROM THE STANDARD PRESSURE MEASUREMENT NETWORK AND THE AIDJEX NETWORK,
Washington Univ., Seattle. Polar Science Center.
E. Leavitt.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 46-56, October 1979. 6 Fig, 3 Tab, 6 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Winds, *Ocean currents, *Path of pollutants, Oil spills, Water pollution effects, Resource development, Baseline studies, Environmental effects, Alaska, *Outer Continental shelf, Oil trajectories, Wind direction, Wind speed, Geostrophic wind, Oil-in-ice, Petroleum development.

Studies of ocean current or ice trajectories require specification of the surface air stress. The normal method is to relate the air stress to the geostrophic wind speed calculated from the gradient of the observed surface pressure field. The accuracy of the National Center for Atmospheric Research (NCAR) data set is examined by comparing it to the AIDJEX geostrophic winds and to measurements of surface winds at Point Barrow (BRW), Barter Island (BTI) and the AIDJEX manned camps. The differences reported here should not seriously affect the conclusions about possible mean oil-in-ice trajectories. There are other variables that were not modelled such as ocean currents, that would have a greater influence on the results. The results do indicate a potential problem for studies of ice dynamics because it is the periods at high wind speeds that will be underestimated most severely by an NCAR type data set. Also, although the direction agrees in the mean, there are large random errors in the wind direction that may be important on shorter time scales. (Sinha-OEIS)
W80-05352

NORTON SOUND/CHUKCHI SEA OCEANOGRAPHIC PROCESSES (N-COP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. D. Muench, J. D. Schumacher, and R. B. Tripp.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 288-309, October 1979. 1 Fig, 2 Tab, 1 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf environmental Assessment Program, Boulder, Colorado.

Descriptors: *Ocean circulation, *Tidal effects, *Sediment transport, *Path of pollutants, Oil pollution, Baseline studies, Resources development, Environmental effects, Water pollution effects, Alaska, *Outer Continental Shelf, Nearshore circulation, Bering Sea/Chukchi Sea, Petroleum development.

Continuing analysis of field data obtained during prior years is enhancing understanding of flow in

the northern Bering Sea, particularly with regard to subtidal fluctuations. Five current meter moorings deployed during summer 1978 yielded data which will help clarify both the regional tides and some aspects of subtidal circulation in the region between Norton Sound and St. Lawrence Island. These data are being provided as necessary input to the tidal modelling effort. Further analysis of the existing field data will address regional tidal behavior and propagation/forcing of subtidal flow events through the system. This study will provide estimates of the trajectories likely to be followed by spilled oil and will furnish an indication of dispersion rates for such oil. Oil introduced into the environment via long-term or chronic leakage is more likely to be dispersed throughout the water column and, possibly, scavened by suspended particulate matter. The problem then becomes one of understanding net transport of suspended matter, a process related to the advective and diffusive fields within the water column. An understanding of these processes requires, in turn, analysis of the velocity field and its driving mechanisms. (Sinha-OEIS)
W80-05355

OIL POOLING UNDER SEA ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. Kovacs.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 310-353, October 1979. 3 Fig, 3 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Ice cover, *Oil spills, *Path of pollutants, Water pollution sources, Environmental effects, Resources development, Arctic, Alaska, Baseline studies, *Outer Continental Shelf, Oil pooling, Petroleum development.

Cross-sectional information on the thickness and bottom relief of sea ice is provided. The subsurface topographic data provide information for determining the direction that oil discharged under fast ice will flow and the quantity of oil which can be expected to pool up within the under-ice relief. The data which have been analyzed to date indicate, as expected, that the cause of the mesoscale relief (5 to 50 cm) found under the fast ice in late winter is due to snow cover variation. In short, where the snow depth is greatest the underlying ice sheet is thinnest due to the insulating effect of the snow, which reduces heat transfer to the atmosphere and therefore ice growth. Studies have shown that where there is a preferred current direction under sea ice the crystal structure of the ice becomes highly ordered. This ordered structure is a complex anisotropic dielectric which was found to be an effective polarizer of transverse electromagnetic waves. Because current effects establish the preferred crystal alignment, the radar signal phenomenon makes it possible to determine the direction of the preferred current under sea ice remotely. Sea ice profiling data from the Tigvariak Island runway site have been partially analyzed and from this information a contour map of a 150-m long section of the profiled runway was made. The profile information shows the strong effect of snow cover variation on under-ice relief and therefore oil pooling potential. (Sinha-OEIS)
W80-05356

THE TRANSPORT AND BEHAVIOR OF OIL SPILLED IN AND UNDER SEA ICE,
Flow Research Co., Kent, WA.
M. D. Coon, and R. S. Pritchard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 354-360, October 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Path of pollutants, *Ice cover, *Water pollution effects, *Oil spills, Baseline studies, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Prudhoe Bay, Petroleum development.

The objective of this work is to determine the locations to which oil spilled in or under the ice cover near Prudhoe Bay, Alaska, would be transported, and to determine the behavior of the oil as the ice cover moves and deforms. To determine the most likely and extreme sea ice motions, the barometric pressure fields, as determined by the U.S. Weather Service for twenty-five years, were used to determine the winds and, through a sea ice dynamics model, the subsequent sea ice motion. The breakout of the sea ice from the Beaufort to the Chukchi Seas was studied using a rigid plastic model for the behavior of the sea ice to determine the meteorological conditions under which breakout may occur. Studies of the possible fate of oil spilled in the Prudhoe Bay area can provide for a move environmentally safe exploration and development of possible off-shore oil. (Sinha-OEIS)
W80-05357

BEAUFORT AND CHUKCHI SEA ICE MOTION. PART 1: PACK ICE TRAJECTORIES,
Flow Research Co., Kent, WA.
D. R. Thomas, and R. S. Pritchard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 361-469, October 1979. 28 Fig, 1 Tab, 34 Ref, 4 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Ice cover, *Path of pollutants, *Oil spills, *Currents(Water), *Wind, Water pollution, Arctic, Resources development, Exploration, Baseline studies, Environmental effects, Weather, *Outer Continental Shelf, *Ice trajectories, Beaufort Sea, Chukchi Sea, Petroleum development.

The petroleum industry's anticipated exploration for oil deposits off the north coast of Alaska will involve many new environmental considerations. In addition to the hazards due to the ice, the generally hostile environment will tend to magnify the chances of an oil spill due to other accidents. Once an oil spill occurs, for whatever reason, the ice cover will play a major role in the behavior of the oil. There are many facets to this role: dispersion of the oil under and around the ice, incorporation of the oil into the ice and the eventual release of that oil, the transport of oil trapped in the ice and prevention or enhancement of cleanup. The purpose of this work is to define the range of motions that might be expected for oil spilled on ice during the lifetime of Prudhoe Bay oil fields. It is generally accepted that the primary driving forces of the ice cover are the winds and currents. It is also expected that the ice conditions (i.e., the 'strength' of the ice cover) can have a dominant influence on how the ice behaves in response to these driving forces. Tracking of an actual oil spill requires wind and current observations and prediction at a particular time as well as day to day use of an ice dynamics model to predict motion due to these winds and currents, not a statistical history. The results are presented in graphical form with monthly mean free drift ice motion fields and plots showing temporal and spatial variability. (Sinha-OEIS)
W80-05358

BEAUFORT AND CHUKCHI SEA ICE MOTION. PART 2: ONSET OF LARGE SCALE CHUKCHI SEA ICE BREAKOUT,
Flow Research Co., Kent, WA.
R. W. Reimer, R. S. Pritchard, and M. D. Coon.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 470-494, October 1979. 9 Fig, 7 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Ice cover, *Path of pollutants, *Sea ice, *Model studies, Flow, Oil spills, Environmental effects, Resources development, Water pollution, Baseline studies, Alaska, *Outer Continental Shelf, *Ice flow, Bering Strait, Petroleum development.

The period of time during which sea ice is present in the Bering Strait region extends, in general, from mid-November to late June. During this time the ice pack undergoes numerous deformation cycles which at times are extensive enough to cause large scale flow of pack ice south through the Strait. Evidence taken from satellite images of the area indicates that this phenomenon is likely to occur at least once every winter. In order to understand when and why this occurs, it is necessary to learn which material properties of the ice pack control such breakout, as well as to understand the physical environment which influences the ice pack. Sea ice responds to the influence of the atmosphere and ocean, as well as to the surrounding ice pack. If the material response of the ice is assumed to be rigid-perfectly plastic then it becomes possible to obtain some analytic solutions to the response of sea ice under various loads. This is the approach used to model ice breakout through the Bering Strait. Three models of ice flow through the Bering Strait are presented. They model failure by boundary tractions, body forces, or combinations thereof. All three models are able to predict the winds required to cause breakout. (Sinha-OEIS)
W80-05359

ICE BREAKOUT IN THE BERING STRAIT,
Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
R. W. Reimer.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investiators for year ending March 1979. Vol VIII, Transport, p 495-564, October 1979. 8 Fig, 9 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Path of pollutants, *Wind, *Flow, Oil spills, Model studies, Baseline studies, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Bering Strait, *Ice flow, Petroleum development.

A rigid-plastic sea ice model developed by the AIDJEX modeling group is used to determine when large-scale ice flow may occur through the Bering Strait. Prediction of failure of an ice arch across the Strait is made in terms of a boundary traction which is related to the strength of winds blowing across the ice pack. The method of solution is to parameterize a wedge-shaped region in the Bering Strait and to model the ice pack in this region as a rigid-plastic material. The choice of a region is based on a visual study of satellite photographs of actual breakout occurrences. A boundary value problem is defined in terms of approximate stress and velocity boundary conditions. Using Prager's theorems on limit analysis, it is shown that an upper and lower bound on a failure load can be calculated if the stresses are assumed constant within subregions of the modeled region. By picking a stress state associated with a kinematically admissible velocity field, a unique failure load is calculated. It is found that for the Bering Strait the failure load is independent of the depth of the modeled region. A simple calculation shows that a wind creating a stress of 0.5 Pa requires a fetch of 200 km to cause breakout. The usefulness of the solution depends primarily on the accuracy of the stress boundary conditions which define the problem. (Sinha-OEIS)
W80-05360

ARCTIC OIL SPILL SCENARIOS - OUTLINE,
Flow Research Co., Kent, WA.
M. D. Coon.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 565-569, October 1979. 2 Fig. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Path of pollutants, *Ocean circulation, Movement, Oil spills, Arctic, Water pollution, Environmental effects, Baseline studies, Resources development, Alaska, *Outer Continental Shelf, *Oil entrapment, Prudhoe Bay, Petroleum development.

Scenarios for twelve conditions will be considered. The conditions will include three separate ice configurations, two different times of year, and two different release volumes. The purpose of this scenario set is to determine the possible fate of oil released into the sea ice in the Prudhe Bay region. The behavior of oil released in the Arctic environment is quite different from the behavior in more temperate climates. The sea ice can act as a natural containment device reducing the areal coverage of a given volume of oil. However, when oil has been entrapped in sea ice, it can remain entrapped for many months before being released to ocean/atmospheric environment or clean up. During the period that the oil is in the ice, it can be transported long distances by the motion of the ice pack. The studies required to understand the spreading of oil beneath sea ice and its subsequent entrapment and transportation by the sea ice are now being conducted. Therefore, at this point only a broad outline of the scenarios can be presented. (Sinha-OEIS)
W80-05361

THE TRANSPORT AND BEHAVIOR OF OIL SPILLED IN AND UNDER SEA ICE - TASK 1,
ARCTEC, Inc., Columbia, MD.
L. A. Schultz, and J. C. Cox.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 570-588, October 1979. 8 Fig, 9 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-78-B01-62.

Descriptors: *Oil spills, *Sea ice, *Movement, Ice cover, Path of pollutants, Baseline studies, Resources development, Water pollution effects, Environmental effects, Alaska, Water pollution, *Outer Continental Shelf, Beaufort Sea, Chukchi Sea, Oil transport.

This study addresses four basic spill related phenomena, slick thickness, the motion of oil beneath smooth ice and ice having small roughness features, the motion of oil beneath ice having large roughness features, and the vertical migration of oil in ice. The purpose of this study is to examine how oil from a spill will interact with the sea ice of the Beaufort and Chukchi Seas. The scope of the problem encompasses both the horizontal movement and the vertical migration of oil. The horizontal transport of oil has been studied in an ice covered laboratory flume. Conclusions on the vertical migration of oil in ice are based on observations made during both field and laboratory experiments. The results of these oil-ice interaction studies will be incorporated into the AIDJEX model of ice dynamics to provide a means for predicting the ultimate fate of oil spilled in ice infested waters. (Sinha-OEIS)
W80-05362

5B. Sources Of Pollution

NITROGEN FERTILIZER MANAGEMENT OF VIGOROUS LEMONS AND NITRATE-POLLUTION POTENTIAL OF GROUNDWATER,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
T. W. Embleton, C. O. Pallares, W. W. Jones, L. L. Summers, and M. Matsumura.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-183510, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, Contribution 182, December 1979. 29 p, 11 Fig, 15 Tab. (California Water Resources Project UCAL-WRC-W-500). OWRT-A-057-CAL(2).

Descriptors: Citrus fruits, *Lemons, Oranges, Fruit crops, Crop production, *Nitrogen, Nitrification, *Nitrogen fixing bacteria, *Nitrates, *Ureas, *Fertilizers, *Foliar application, Groundwater, *Water pollution, Leaching.

The mission of this project was to develop practical citrus nitrogen fertilizer management programs that would reduce nitrate-pollution potential without having adverse effects on fruit yield, size, and quality. Studies were conducted on 'Washington' navel orange and 'Limoneira 8a Lisbon' lemon. Supplying the trees' nitrogen needs by means of urea foliar sprays resulted in a lower nitrate-pollution potential than by applying nitrogen fertilizer to the soil. An increase in the annual soil-applied nitrogen rate was associated with an increase in the nitrate-pollution potential. November applied nitrogen treatments to lemons were associated with a higher nitrate-pollution potential than the same annual nitrogen rate applied in March, or in a split application. Experimental treatments to lemons did not influence drainage volumes (the amount of water passing below the rootzone annually). Nitrogen leach was not significantly correlated with drainage volume. Very highly significant linear correlations were observed for the following: Nitrogen leached vs. nitrogen rate, nitrogen leached vs. nitrate-nitrogen concentration in drainage water, and nitrate-nitrogen concentrations in drainage water vs. nitrogen rate. An increase in soil-applied nitrogen rate to lemons increased the amount of nitrogen removed in the harvested crop. For a given annual nitrogen rate, foliar-applied treatments were associated with a substantially greater amount of nitrogen removed in the harvested crop than were the soil-applied treatments. (Snyder-California)
W80-05103

INFLUENCE OF REGOLITH PROPERTIES ON MIGRATION OF SEPTIC TANK EFFLUENT,
University of South Florida, Tampa. Dept. of Geology.
R. A. Rea, and S. B. Upchurch.
Ground Water, Vol 18, No 2, p 118-125, March-April 1980. 6 Fig, 1 Tab, 28 Ref.

Descriptors: *Septic tanks, *Groundwater, *Path of pollutants, *Groundwater movement, *Regolith, Nutrients, Pollutants, Nitrates, Chlorides, Phosphorus, Hydrogen ion concentration, Soils, Soil water, Adsorption, On-site investigations, Sampling, Chemical analysis, Mathematical models, Hydrogeology, Hydrology, Soil adsorption.

An investigation of waste-migration patterns from a septic system indicated that complex patterns result from minor variations in regolith adsorptive capacity and texture, local hydrology, and possibly soil microbiology. The existence of multichemical, bifurcating plumes suggested that monitor wells arranged up and downgradient and capable of multilevel sampling are essential to adequately delineate contaminant migration in groundwater. The data also indicated that sampling for a single constituent could yield misleading information about the nature and distribution of other groundwater contaminants. The ability for chemical removal by the regolith is in direct response to minor variations in silt- and clay-sized particle content and corresponds to Langmuir adsorption isotherms. Silt- and clay-sized particles are dominantly organic in origin. Minor iron and aluminum hydroxyoxides and clays are present. Substrate samples, when collected at regular intervals and analyzed for adsorbed constituents and textural variability, provided an integrated picture of the distribution of waste chemicals through time. Such samples also provided insight into the mechanics of plume configuration and flow characteristics within the regolith. The study showed that regolith adsorption data are essential to the determination of life expectancy of the regolith as a contaminant treatment system. (Sims-ISWS)
W80-05124

REQUIREMENTS OF STATE REGULATORY AGENCIES FOR MONITORING GROUNDWATER QUALITY AT WASTE DISPOSAL SITES,
Minnesota Pollution Control Agency, Minneapolis.
For primary bibliographic entry see Field 5A.
W80-05129

REACTOR-RELEASED RADIONUCLIDES AND FINE-GRAINED SEDIMENT TRANSPORT AND ACCUMULATION PATTERNS IN BARNEGAT BAY, NEW JERSEY AND ADJACENT SHELF WATERS,
Lamont-Doherty Geological Observatory, Palisades, NY.
C. R. Olsen, P. E. Biscaye, H. J. Simpson, R. M. Trier, and N. Kostyk.
Estuarine and Coastal Marine Science, Vol 10, No 2, p 119-142, February 1980. 5 Fig, 7 Tab, 27 Ref. ERDA EY-76-S-02-2185, EY-76-S-02-2529.

Descriptors: *Radioisotopes, *Nuclear powerplants, *Fallout, *Sediments, *New Jersey, On-site investigations, Sampling, Coasts, Bays, Continental shelf, Water pollution, Water pollution sources, Sediment transport, Spatial distribution, Temporal distribution, Cobalt radioisotopes, Cesium, Pollutants, Path of pollutants.

Anthropogenic radionuclides have been introduced into the Barnegat Bay environment via global fallout from nuclear weapons testing and by low-level discharges from the Oyster Creek Nuclear Generating Station. A significant portion of these radionuclides have been adsorbed to fine-grained particles and consequently provide excellent tracers for fine-sediment transport and accumulation patterns in the Bay and adjacent shelf environment. Fine-grained particles tagged with reactor nuclides are presently accumulating along the landward shore of Barnegat Bay at rates between 1 and 7 cm/year. There is some indication that reactor-tagged sediments are also being transported into the mouths of small tributaries which discharge into the Bay. Reactor-tagged particles that escape from the Bay, through Barnegat Inlet, onto the shelf, are accumulating during the summer with fine-grained material from other sources, in depressions along the shelf bottom. These near-shore mud deposits are apparently resuspended and dispersed by major storms probably on a seasonal basis. By comparing radionuclide ratios in the reactor releases with the ratios observed in the fine-grained sediments in the vicinity of the reactor, it appears that (1) 35% to 50% of the total 137Cs activity in the top 30 cm of the sediments in Oyster Creek is attributable to reactor releases; (2) if transuranic releases have occurred from the Oyster Creek Reactor, the increments of 239, 240Pu and 238Pu are not distinguishable from the fallout plutonium burden in the sediments; and (3) radiocobalt is removed from the liquid effluent and stored in the sediments at least 20 X more effectively than radiocesium. (Sims-ISWS)
W80-05130

COMPARATIVE NUTRIENT DYNAMICS OF A MARSH-MUDFLAT ECOSYSTEM,
Connecticut Univ., Groton. Marine Sciences Inst.
B. L. Welsh.
Estuarine and Coastal Marine Sciences, Vol 10, No 2, p 143-164, February 1980. 9 Fig, 6 Tab, 39 Ref. Army DACW 33-75-C-0059.

Descriptors: *Nutrients, *Water chemistry, *Rivers, *Estuaries, *New England, Tidal waters, Coasts, Marshes, Salt marshes, Sampling, Surveys, Nitrates, Nitrites, Ammonia, Phosphates, Tides, Tidal effects, Circulation, Water circulation, Pollutants, Water pollution, Path of pollutants.

An open marsh front, its adjacent mudflat, and a dredged channel in the Branford River estuary on the north shore of Long Island Sound were compared to determine their individual contributions to nutrient dynamics in the overall system, to identify mechanisms involved, and to evaluate whether open-system dynamics agreed with those reported for closed systems. Basic patterns of nutrient flux differed between areas, between tidal phases, and between summer and fall. The relative magnitudes of nutrient activity generally were: ammonia greater than phosphate greater than nitrate greater than

nitrite, regardless of area, tide, or season. The channel consistently exported materials. The marsh was heterotrophic with respect to tidal water, removing oxygen and releasing large quantities of phosphate and ammonia, especially during summer months. The mudflat was autotrophic during the day, recharging passing waters with oxygen and effectively removing the pulses of nutrients released from the marsh. Both marsh and mudflat strongly conserved nitrate. Nutrient removal over the mudflat was due to uptake by geochemical or biological activity of the sediments and to the macrophyte, Ulva latuca. During its growing season, Ulva was suspended by tides which increased its area of contact with passing water 6-20 times that of the underlying mudflat surface and added a third dimension to the epibenthic component. The flood tide physically entrained mudflat surface sediments and their associated high-nutrient pore waters, which increased nutrient concentrations in the water column. Through removal on the ebb and recharge on the flood, a steep gradient was maintained between marsh and channel, especially during summer when Long Island Sound water was most nutrient depleted and represented a potential leaching stress. (Sims-ISWS)
W80-05131

WATER QUALITY TRAP EFFICIENCY OF STORM WATER MANAGEMENT BASINS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W80-05139

FIELD AND MODEL RESULTS FOR MULTIPORT DIFFUSER PLUME,
Tennessee Valley Authority, Norris.
C. W. Almquist, C. D. Ungate, and W. R. Waldrop.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 27-37, 1978. 6 Fig, 6 Ref.

Descriptors: *Model studies, *Hydraulic structures, *Heated water, *Reservoirs, Mathematical models, On-site investigations, Diffusion, Water temperature, Spatial distribution, Analysis, Analytical techniques, Currents(Water), Velocity, Thermal plume, Multiport diffuser.

The three-unit Browns Ferry Nuclear Plant of the Tennessee Valley Authority (TVA) has a net generating capacity of 3456 MW. Condenser cooling water from this plant is discharged into Wheeler Reservoir through a submerged multiport diffuser at temperature rises of up to 25F. Alabama water quality standards limit the plant-induced mixed temperature rise in the reservoir to 5F. Because the plant may operate either with or without cooling towers, the ability to predict accurately plant-induced temperature rises has a direct bearing on plant efficiency. In this paper, an analytical model for predicting the plant-induced temperature rise was presented, and results from a field study under controlled conditions were discussed and compared with model predictions. Field data collection programs should be designed so as to best take advantage of available techniques for data analysis. In this respect, large area, multidimensional contour maps may not be as useful as measurements at fixed points or over a smaller area of the temperature field. This should be taken into consideration in the design of field tests. Analytical and empirical models of diffuser performance offer a relatively simple means of adequately predicting many aspects of diffuser performance. The reasonable agreement of the very simple model with observed temperatures has provided the impetus for the development of a more general, comprehensive model of diffuser performance. (See also W80-05159) (Humphreys-ISWS)
W80-05160

AN ANALYSIS OF TOTAL PHOSPHORUS TRANSPORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
F. H. Verhoff, D. A. Melfi, and S. M. Yaksich.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 147-155, 1978. 6 Fig, 5 Ref.

Descriptors: *River systems, *Water quality, *Model studies, *Ohio, Phosphorus, Analytical techniques, Analysis, Mathematical models, On-site data collections, Hydrographs, Distance, Phosphorus transport, Mass balance, Chemograph.

Two views of phosphorus transport during storms can be summarized as follows. The continuous flow theory envisions the total phosphorus as being washed from the land, through the river system, and into the receiving water body during one storm event. The discontinuous theory would propose that the phosphorus is moved from the land and through the stream by a series of flood waves. The first wave would carry the material from the land into the river bed. The second wave would pick up the total phosphorus, carry it some distance, and redeposit it in the river again. This process would continue until the total phosphorus reaches the receiving water body. The first section of this paper involved mathematical modeling which demonstrated that total phosphorus was transported by a resuspension-deposition process. The second section contains a methodology for calculating the net distance of travel for total phosphorus during a storm event. The last section uses the fact of increasing concentration with increasing flow to develop our total phosphorus flux estimating technique. The modeling indicates that total phosphorus is transported by a resuspension-deposition process. The distance of travel was calculated from information at a point in a river. During large storms, most of the total phosphorus passing mainstem stations reaches Lake Erie. The total phosphorus flux entering the lake was estimated at USGS gaging station by a flow interval method. (See also W80-05159) (Humphreys-ISWS)
W80-05171

A DYNAMIC ESTUARY MODEL OF CHARLESTON HARBOR,
CH2M/Hill, Reston, VA.
For primary bibliographic entry see Field 2L.
W80-05178

VERIFICATION OF A YORK RIVER ECOSYSTEM MODEL,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5C.
W80-05180

SIMULATION OF ALGAL GROWTH IN THE CHOWAN RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W80-05181

MATHEMATICAL MODELING OF SEDIMENT AND CONTAMINANT TRANSPORT IN THE JAMES RIVER ESTUARY,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2J.
W80-05185

FIELD VERIFICATION OF A HYDROTHERMAL MODEL,
Worcester Polytechnic Inst., Holden, MA. Alden Research Labs.
G. E. Hecker, and J. J. Markowsky.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 326-334, 1978. 3 Fig, 3 Ref.

Descriptors: *Cooling water, *Thermal pollution, *Lake Michigan, *Model studies, Hydraulic models, On-site investigations, Calibrations, Heated water, Discharge(Water), Temperature, Water temperature, Powerplants, Water circulation, Currents(Water), Lakes.

Hydraulic models are frequently used to predict temperature rise patterns produced by heated discharges from steam-electric stations. Although considerable progress has been made in analytic techniques in recent years, no reliable analysis was available to predict the dilution of buoyant effluent discharged at relatively high velocity from two submerged and adjacent slots in shallow water. Complex flow interactions and boundary effects prompted the use of a physical model to develop a discharge concept for the Donald C. Cook Nuclear Plant on Lake Michigan such that the thermal plume would meet applicable temperature rise criteria. Subsequent to the start-up of Unit 1 of the two unit plant, an extensive field monitoring program was supported to check compliance with thermal regulations. A few of the numerous thermal plumes were gathered under ambient lake conditions similar to those used in the physical model, and a model-field comparison was, therefore, possible. (See also W80-05159) (Sims-ISWS)
W80-05187

A MATHEMATICAL MODEL FOR WATER QUALITY ANALYSIS,
Virginia Inst. of Marine Science, Gloucester Point.
H. S. Chen.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 350-357, 1978. 4 Fig, 6 Ref.

Descriptors: *Water quality, *Hydrodynamics, *Biochemistry, *Model studies, Mathematical models, Rivers, Bays, Estuaries, Water circulation, Pollutants, Dispersion, Path of pollutants, Equations, Mathematics, Calibrations, James River Estuary(VA).

When wastes are introduced to a natural water body, they are, in general, subject to the coupled influence of hydrodynamic transport processes and biochemical reaction processes. The former, mainly depending on flow circulation, includes advection, mixing, and dispersion of the constituents of the wastes, while the latter, which leads to production or decay or transformation of the constituents through biochemical interaction, depends on both the biochemical characteristics of the constituents of the wastes and the hydrodynamic behavior of the water body. The purpose of this work was to develop a real-time, two-dimensional, depth-integrated mathematical model, which depicts a hydrodynamic and biochemical water quality system to predict flow circulation, water elevation, and water quality response in a natural water body such as river, estuary, or sea. (See also W80-05159) (Sims-ISWS)
W80-05190

WATER QUALITY MODELING USING HYDROCOMP SIMULATION PROGRAMMING (HSP),
Hydrocomp, Inc., Palo Alto, CA.
R. G. Bourne, G. N. Day, and T. N. Debo.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 358-362, 1978. 1 Fig.

Descriptors: *Water quality, *Rivers, *Model studies, Mathematical models, Calibrations, Flow, Streamflow, Chemicals, Pollutants, Oxygen, Dissolved oxygen, Bacteria, Nutrients, Water temperature, Solar radiation, Winds, Humidity, Hydrology.

Hydrocomp Simulation Programming (HSP) is a mathematical model capable of continuously simulating the hydrologic and water quality responses of a watershed. Continuous simulation essentially refers to use of long-term precipitation records to generate long-term flows. From the flows, the dynamic processes controlling water quality can be simulated for extended periods. The basic philosophy undergirding the simulation of water quality (using HSP) is that hydrology is a major mechanism controlling critical situations, assimilative capacity, and many other water quality processes.

From the long-term simulation of water quality, probabilities of a particular event can be determined. For example, the percent of time DO falls below 5 mg/l can be estimated. The model incorporates many of the basic physical, chemical, and biological processes controlling water quality and can include factors which impact it (e.g., point and nonpoint loads). However, only as much confidence can be placed in simulation results as can be placed in the data base used for calibration and verification. (See also W80-05159) (Sims-ISWS)
W80-05191

CALIBRATION OF URBAN NONPOINT POLLUTION LOADING MODELS,
Northern Virginia Planning District Commission, Falls Church.
J. P. Hartigan, A. M. Lumb, J. T. Smullen, T. J. Grizzard, and P. A. Alcivar.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 363-372, 1978. 3 Tab, 14 Ref, 1 Append.

Descriptors: *Water pollution sources, *Urban runoff, *Model studies, Mathematical models, Cities, Pollutants, Water pollution, Path of pollutants, Monitoring, Chemical oxygen demand, Lead, Zinc, Phosphorus, Nitrogen, Land use, Runoff, Hydrology, Calibrations, Nonpoint water pollution sources.

Recent studies have begun to quantify the magnitude of pollution loadings from nonpoint sources and to question water quality management strategies founded solely on point source abatement. In order to evaluate trade-offs between point and nonpoint pollution control strategies for an urban area, existing and projected nonpoint pollution loadings must be characterized. Such characterizations are generally based on applications of mathematical models that utilize relationships between land use characteristics and the timing and magnitude of runoff pollution releases. Useful relationships between point source pollution loadings and land use (i.e., population equivalents) are readily available in standard reference texts. Appropriate relationships between nonpoint pollution loadings and urban and rural-agricultural land uses are not so readily available. This paper described the use of continuous simulation model calibration techniques to derive 'urban land use-nonpoint pollution' correlations for subsequent model applications in mixed land use watersheds. Major elements in a runoff pollution field study that produced the required model calibration data were summarized. Hydrology and water quality calibration results were presented. Simulated unit area loading rates from the pervious and impervious fractions of urban land uses were compared. (See also W80-05159) (Sims-ISWS)
W80-05192

MODEL VERIFICATION USING THE PLUG-FLOW TECHNIQUE,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resource Dept.
S. M. Brown, and A. Brandstetter.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 373-380, 1978. 7 Fig, 2 Ref, 1 Append.

Descriptors: *Rivers, *Path of pollutants, *Flow, *Model studies, Mathematical models, Calibrations, Water quality, Nutrients, Algae, Water temperature, Chemicals, Dissolved oxygen, Hydrology, Plug-flow technique.

A unique approach to steady-state river water quality modeling has been found to be especially useful in the model calibration/verification process. This approach, known as the plug-flow technique, involves the routing of a hypothetical plug of water through successive river reaches according to flow travel time. This routing procedure makes it possible to incorporate the effects of certain time-varying water quality factors, such as algal photosynthesis/respiration, water temperature, waste loads, and tributary inflows, into the simulation structure of a steady-state model. Model calibration and verification using this approach requires water quality data which are functionally related to river travel time. In support of a 208 Areawide Waste Management Planning Study, the plug-flow technique was used to calibrate and verify a steady-state model which simulates the important water quality phenomena affecting dissolved oxygen changes in rivers, including the effects of waste loads, nutrient cycling, algal activity, and water temperature. Approximately 50 miles of the Chemung River system in New York, including the lower Cohocton River and seven municipal and industrial waste sources, were modeled. In addition to model verification, the plug-flow approach proved to be extremely valuable in waste-load allocation studies where both minimum and average daily dissolved oxygen concentrations had to be simulated for comparison with the New York State water quality standards. (See also W80-05159) (Sims-ISWS)
W80-05193

PLANNING IMPLICATIONS OF WASTE-LOAD ASSIMILATIVE CAPACITY OF COLEMAN CREEK AND FLAT CREEK, MECKLENBURG COUNTY, VIRGINIA,
Virginia State Water Control Board, Richmond. Piedmont Regional Office.
C. T. Bathala, K. C. Das, and W. D. Jones.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 472-482, 1978. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Water quality, *Water pollution, *Path of pollutants, *Model studies, *Virginia, Mathematical models, Planning, Water pollution sources, Dispersion, On-site data collections, Calibrations, Pollutants, Biochemical oxygen demand, Dissolved oxygen, Nitrogen, Effluents, Water temperature, Streams, Streamflow.

This paper summarized the results of waste-load assimilation analyses of Coleman Creek at Boydton and Flat Creek near South Hill, Virginia, and the possible impact on these communities. Coleman Creek and Flat Creek are two small, free-flowing streams in the South Piedmont Region of Virginia. The assimilative capacity of each stream was analyzed by using modified Streeter-Phelps methodology, a water quality model for self-purification of small streams. Each model was calibrated and verified using two different sets of field data. Based on the results of these studies, it became apparent that very stringent effluent limits, overtaxing the financial capabilities of these communities, would be needed to maintain the existing stream DO standards. (See also W80-05159) (Sims-ISWS)
W80-05199

EFFECTS OF EQUATION AVERAGING ON MODEL VERIFICATION,
South Carolina Univ., Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-05200

A GRAPHICAL COMPUTATION SYSTEM FOR THREE-DIMENSIONAL LAKE CIRCULATION AND CONTAMINANT DISPERSION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 7C.
W80-05205

A STOCHASTIC-DYNAMIC APPROACH TO THE FOUNDATIONS OF SOLUTE TRANSPORT IN POROUS MEDIA,
Mississippi Univ., University. Dept. of Civil Engineering.
V. K. Gupta, R. N. Bhattacharya, and G. Sposito.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 621-629, 1978. 26 Ref.

Descriptors: *Porous media, *Solutes, *Movement, *Theoretical analysis, Mathematical models, Water quality, Analytical techniques, Analysis, Stochastic processes, Statistical methods, Flow, Mathematical studies, Solute transport.

The authors developed a stochastic theory explicitly based on dynamic considerations. Since the dynamics were specified at the molecular level, the theory did not require that a hydrodynamic description be applicable at the 'pore level.' This fact also enabled the authors to avoid making restrictive and artificial assumptions on the geometry of a porous medium. (See also W80-05159) (Humphreys-ISWS)
W80-05216

STOCHASTIC WATER QUALITY MODEL,
Auburn Univ., AL. Dept. of Civil Engineering.
L. C. Bell.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 638-644, 1978. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Water quality, *Mathematical models, *Stochastic processes, *Oxygen sag, Statistical methods, Model studies, Dissolved oxygen, Statistical models, Analytical techniques, Monte Carlo method, Streamflow, On-site investigations, Model verification.

The stochastic water quality model DOSIM was developed to provide water quality planners with a more realistic oxygen sag analysis of small streams without the added expense of an expanded data base. The familiar Streeter-Phelps oxygen sag equation with a suitable modification for nitrification was selected as a basic mathematical equation. Monte Carlo methods were employed to generate downstream dissolved oxygen histograms from input data in the form of histograms, probability density functions, or constant values. In this study historical data supplied by the state regulatory agency was inadequate for validation purposes because of the large time span involved and the resulting wide variation in flow and runoff parameters. A carefully controlled monitoring of a local stream during the late summer months did, however, produce data compatible with model assumptions, and validity was ascertained using the nonparametric Kolmogorov-Smirnov test. (See also W80-05159) (Humphreys-ISWS)
W80-05218

SEDIMENT AND PCB TRANSPORT MODEL OF THE HUDSON RIVER,
Lawler, Matusky and Skelly Engineers, Pearl River, NY.
For primary bibliographic entry see Field 2J.
W80-05219

VERIFICATION OF TRANSIENT MIXED-FLOW MODEL,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W80-05224

TWO-DIMENSIONAL TIDALLY AVERAGED ESTUARINE MODEL,
Humboldt State Univ., Arcata, CA. Dept. of Environmental Resources Engineering.
For primary bibliographic entry see Field 2L.
W80-05251

QUANTITATIVELY TRACING BACTERIAL TRANSPORT IN SATURATED SOIL SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Microbiology.
E. L. McCoy, and C. Hagedorn.
Water, Air, and Soil Pollution, Vol 11, No 4, p

467-479, May 1979. 4 Fig, 2 Tab, 26 Ref. OWRT A-039-ORE(3), 14-34-0001-9039.

Descriptors: *E. coli, *Water pollution sources, *Septic tanks, *Groundwater, Soil environment, Saturated flow, Soil water, Enteric bacteria, Groundwater movement, Perched water, Water table, Water pollution, Coliforms, Hazards, Public health, Transport, Fecal organisms.

Three isolates of Escherichia coli were labeled by their resistance to sodium azide and, separately, to novobiocin, nalidixic acid, and tetracycline. The strains exhibited a high degree of persistence in the soil environment and were recoverable on strain specific media at levels within the 95% confidence interval of the numbers covered on nonselective media. The E. coli strains were subsequently used to evaluate the events which would occur when a septic tank drainfield became submerged in a perched water table and effluent-borne bacteria escaped into the groundwater. Field experiments were conducted by introducing the strains into horizontal lines installed into the A, B, and C horizons of a soil profile, and transport was evaluated by collecting groundwater samples from 5 rows of piezometers (sampling 6 separate depth zones/row) located downslope from the injection lines. The major portion of subsurface transport of the bacterial populations occurred in specific zones in the soil profile and at an apparent maximum velocity of 17.0 cm/min. The maximum bacterial density in the groundwater, observed at each sampling distance downslope, was used to produce a mathematical relationship which described the overall decrease in numbers of organisms with increased distance through the soil. The potential health hazards which could occur by the subsurface transport of fecal organisms in relation to these experiments were discussed. (Visocky-ISWS)
W80-05252

WATER QUALITY MODELING IN THE UPPER REACHES OF THE CHOWAN RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
D. N. Contractor, and P. H. King.
Water Resources Bulletin, Vol 16, No 1, p 118-126, February 1980. 10 Fig, 1 Tab, 14 Ref. OWRT B-074-VA(2).

Descriptors: *Water quality, *Rivers, *Algae, *Model studies, Mathematical models, Nutrients, Pollutants, Water pollution, Path of pollutants, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Nitrogen, Nitrogen compounds, River flow, Streamflow, Hydrology, *Chowan River(VA-NC).

The Chowan River system consists of three rivers in southeast Virginia that form two confluences before flowing into Albermarle Sound in North Carolina. A computer program was written to simulate flows through the river system to determine flow rates, velocities, and depths. The output of the flow program was input into a second program that calculated the concentrations of BOD5, COD, DO, and four nitrogen parameters (organic, ammonia, nitrite-nitrate, and algal-N). Measured field data were used to calibrate the model. The effect of reducing the concentration of nutrients from overland runoff on algal concentrations at the mouth of the river was studied. The program was also run to simulate the water quality of the watershed in a primitive condition, in which the watershed was assumed to consist only of forests. The results of the computer program indicate that the major changes in the water quality of the river are simulated satisfactorily. The program can be used to assess the impact of any management scheme to improve water quality. (Sims-ISWS)
W80-05253

MODIFYING AUTOMATED PUMPING SAMPLERS FOR USE IN SMALL MOUNTAIN STREAMS,
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 5A.
W80-05256

IRRIGATOR INVOLVEMENT IN THE IMPLEMENTATION OF AGRICULTURAL NONPOINT SOURCE POLLUTION CONTROL PROGRAMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5G.
W80-05257

DISSOLVED OXYGEN IN INTRAGRAVEL WATER OF THREE TRIBUTARIES TO REDWOOD CREEK, HUMBOLDT COUNTY, CALIFORNIA,
Geological Survey, Helena, MT.
P. F. Woods.
Water Resources Bulletin, Vol 16, No 1, p 105-111. February 1980. 4 Fig, 4 Tab, 22 Ref.

Descriptors: *Dissolved oxygen, *Streams, *Gravels, *California, Tributaries, Forestry, Lumbering, Water quality, Oxygen, Sampling, On-site investigations, Fish, Salmon, Fish eggs, *Intragravel water, *Redwood Creek(CA), *Redwood National Park(CA).

As part of a study of Redwood National Park in northwestern California, an investigation was conducted from June to November 1974 on intragravel dissolved oxygen and sediment in three tributaries to Redwood Creek, a major coastal stream that flows through Redwood National Park. Of concern was whether the intragravel environment of streams in logged and unlogged redwood-forested drainage basins was different. The tributary in the unlogged drainage basin had lower percentages of fine streambed sediment than either of the tributaries in logged drainage basins. Concentration and percentage saturation of dissolved oxygen of intragravel water were highest in the stream in the unlogged drainage basin, intermediate in the stream in the patch-cut drainage basin, and lowest in the stream in the clear-cut drainage basin. The differences in intragravel dissolved-oxygen conditions among the three tributaries are attributed chiefly to differences in their interchange of surface and intragravel water. The larger quantities of fine streambed sediment in the two streams in logged basins may have reduced the permeability of the streambeds and hence their capacity to interchange surface and intragravel water. However, differences in the lithology of the three tributary drainage basins examined may contribute to the differences in the percentage of fine sediments observed among the streams, even in the absence of logging. (Sims-ISWS)
W80-05259

COLIFORMS AND WATER QUALITY: USE OF DATA IN PROJECT DESIGN AND OPERATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
K. W. Thornton, J. F. Nix, and J. D. Bragg.
Water Resources Bulletin, Vol 16, No 1, p 86-92, February 1980. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Water quality, *Coliforms, *Path of pollutants, *Reservoirs, *Arkansas, Rivers, Projects, Design, Bacteria, E. Coli, Pathogenic bacteria, Water pollution, Surface waters, Flow, Turbidity, Sampling, On-site investigations, *Caddo River(AR), *DeGray Reservoir(AR).

Knowledge of coliform transport and disappearance may provide information for project design and operation that minimizes potential water quality problems such as the violation of body contact recreation standards. Storm events were sampled in the Caddo River above DeGray Reservoir, Arkansas, and then tracked through the reservoir using the increased turbidity associated with the storm flows. Fecal coliforms were sampled both in the river and throughout the water column in the reservoir. In general, increased fecal coliform concentrations were closely associated with the increased turbidity resulting from the storm flows. This association existed for all three types of turbidity plume movement--overflow, interflow, and underflow. As the turbidity plume moved down the reservoir, fecal coliform concentrations decreased due to die-off, settling, and dilution. With several assumptions, it is possible to use this information to assist in locating recreational sites in a reservoir or to anticipate possible body contact standard violations at existing recreation sites. (Sims-ISWS)
W80-05262

WATER QUALITY PROJECTIONS: PREIMPOUNDMENT CASE STUDY,
Maryland Univ., College Park, Dept. of Civil Engineering.
R. H. McCuen, D. E. Cook, and R. L. Powell.
Water Resources Bulletin, Vol 16, No 1, p 79-85, February 1980. 9 Tab, 8 Ref.

Descriptors: *Water quality, *Reservoirs, *Model studies, *Maryland, Mathematical models, Data collections, Basic data collections, Surface waters, Runoff, Urban runoff, Precipitation(Atmospheric), Pollutants, Water temperature, Turbidity, Dissolved solids, Dissolved oxygen, Nutrients, Coliforms, Biochemical oxygen demand, Land use, Urbanization.

Recent regulations require impact statements for major water development projects, including reservoirs that will be used for water supply, recreation, and pollution control. A water quantity/quality model was developed and used for making water quality projections of a proposed reservoir in Montgomery County, Maryland. The study area was uncommon in that there was an extensive water quality data base. The results indicated that land use changes will have a significant effect on water quality and that the proposed reservoir will improve the quality of the surface waters downstream from the reservoir. A major effect of land use changes is the increase in the variability of water quality. (Sims-ISWS)
W80-05263

SURFACE DISTRIBUTIONS OF AEROBIC HETEROTROPHS AND THEIR RELATIONSHIPS TO TEMPERATURE AND NUTRIENTS IN LAKE SUPERIOR DURING 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05272

ORGANOCHLORINE SUBSTANCES IN LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05274

SIMULATION OF WATER CIRCULATIONS AND CHLORIDE TRANSPORTS IN LAKE SUPERIOR FOR SUMMER 1973,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05280

MODERN MARINE SEDIMENTS AS A NATURAL ANALOG TO THE CHEMICALLY STRESSED ENVIRONMENT OF A LANDFILL,
Geological Survey, Reston, VA. Water Resources Div.
M. J. Baedecker, and W. Back.
Journal of Hydrology, Vol 43, p 393-414, 1979. 9 Fig, 1 Tab, 48 Ref.

Descriptors: *Geochemistry, *Sediments, *Chemical reactions, *Environmental effects, *Landfills, Path of pollutants, Organic compounds, Fermentation, Oxidation-reduction potential, Gases, Leachate, Waste disposal, Isotope fractionation, Aquifers, Groundwater movement, Water quality, Delaware.

Chemical reactions that occur in landfills are analogous with those reactions that occur in marine sediments. Lateral zonation of C, N, S, O, H, Fe, and Mn species in landfills is similar to the vertical zonation of these species in marine sediments and results from the following reaction sequence: (1)

oxidation of C, N, S species in the presence of dissolved free oxygen to HC03(-), N03(-), and S04(=), (2) after consumption of molecular oxygen, then N03(=) is reduced and FE and Mn are solubilized, (3) S04(=) is reduced to sulfide, and (4) organic compounds become the source of oxygen, and CH4 and NH4 (+) are formed as fermentation products. In a landfill in Delaware the oxidation potential increases down-gradient and the redox zones in the reducing plume are characterized by: CH4(-), NH4(+), Fe(++), Mn(++), HC03(-), and N03(-). Lack of S04(=) at that landfill eliminates the sulfide zone. Although it has not been observed at landfills, mineral alteration should result in precipitation of pyrite and/or siderite downgradient. Controls on the pH of leachate are the relative rates of production of HC03(-), NH4(+), and CH4. Production of methane by fermentation of landfills results in carbon-13 isotope fractionation and the accumulation of isotopically heavy Sigma C02 (+10% to +18%)PDB. Isotope measurements may be useful to determine the extent of C02 reduction in landfills and extent of dilution downgradient. The boundaries of reaction zones in stressed aquifers are determined by head distribution and flow velocity. Thus, if the ground-water flow is rapid relative to reaction rates, redox zones will develop downgradient. Where ground-water flow velocities are low the zones will overlap to the extent that they may be indeterminate. (Kosco-USGS)
W80-05293

DIGITAL-TRANSPORT MODEL STUDY OF DIISOPROPYLMETHYLPHOSPHONATE (DIMP) GROUND-WATER CONTAMINATION AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. Warner.
Available from: OFSS, Box 25425, Fed Ctr, Denver CO 80225. Price codes: $5.50 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-676, August 1979. 39 p, 25 Fig, 6 Ref.

Descriptors: *Model studies, *Groundwater, *Water pollution, *Chemical wastes, *Path of pollutants, Waste disposal, Ponds, Groundwater movement, Groundwater barriers, Aquifer characteristics, Mathematical models, Evaluation, Colorado, *Rocky Mountain Arsenal(Colo), *Digital transport model, *Diisopropylmethylphosphonate.

Diisopropylmethylphosphonate (DIMP) is an organic compound produced as a by-product of the manufacture and detoxification of GB nerve gas. Ground-water contamination by DIMP from the disposal of wastes into unlined surface ponds at the Rocky Mountain Arsenal occurred from 1952 to 1956. A digital-transport model was used to determine the effects on ground-water movement and on DIMP concentrations in the ground water of a bentonite barrier in the aquifer near the northern boundary of the arsenal. The transport model is based on an iterative-alternating-direction-implicit mathematical solution of the ground-water-flow equation coupled with a method-of-characteristics solution of the solute-transport equation. The model assumes conservative (nonreactive) transient transport of DIMP and steady-state ground-water flow. In the model simulations, a bentonite barrier was assumed that was impermeable and penetrated the entire saturated thickness of the aquifer. Ground water intercepted by the barrier was assumed to be pumped by wells located south (upgradient) of the barrier, to be treated to remove DIMP, and to be recharged by pits or wells to the aquifer north (downgradient) of the barrier. The amount of DIMP transported across the northern boundary of the arsenal was substantially reduced by a ground-water-barrier system of this type. For a 1,500-foot-long bentonite barrier located along the northern boundary of the arsenal near D Street, about 50 percent of the DIMP that would otherwise cross the boundary would be intercepted by the barrier. This barrier configuration and location were proposed by the U.S. Army. Of the ground water with DIMP concentrations greater than 500 micrograms per liter, the safe DIMP-concentration level determined by the U.S. Army, about 72 percent would be intercepted by the barrier system. The amount of DIMP underflow intercepted may be increased to 65 percent by doubling the pumpage, or to 73 percent by doubling the length of the barrier. (Kosco-USGS)
W80-05297

WATER IN THE PENSACOLA, FLORIDA, AREA.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-05298

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR SOUTH FORK WILDCAT CREEK, CLINTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-05299

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR CEDAR CREEK, DEKALB AND ALLEN COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. G. Wilber, J. G. Peters, M. A. Ayers, and C. G. Crawford.
Geological Survey open-file report 79-1062, June 1979. 79 p, 30 Fig, 11 Tab, 47 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilative capacity, *Water quality, *Indiana, Streams, Streamflow, Low-flows, Effluents, Forecasting, Water quality standards, Water pollution, Waste water disposal, Reaeration, Waste water treatment, Mathematical models, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, *Dekalb County(Ind), *Allen County(Ind), *Cedar Creek(Ind).

A digital model calibrated to conditions in Cedar Creek was used to develop alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. The model indicates that the dissolved-oxygen concentration of the Auburn wastewater effluent and nitrification are the most significant factors affecting the dissolved-oxygen concentration in Cedar Creek during summer low flows. The observed dissolved-oxygen concentration of the Auburn wastewater effluent was low and averaged 30 percent of saturation. Projected nitrogenous biochemical-oxygen demand loads, from the Indiana State Board of Health, for the Auburn and Waterloo wastewater-treatment facilities will result in violations of the current instream dissolved-oxygen standard (5 mg/l), even with an effluent dissolved-oxygen concentration of 80 percent saturation. Natural streamflow for Cedar Creek upstream from the confluence of Willow and Little Cedar Creeks is small compared with the waste discharge, so benefits of dilution for Waterloo and Auburn are minimal. The model also indicates that, during winter low flows, ammonia toxicity, rather than dissolved oxygen, is the limiting water-quality criterion in the reach of Cedar Creek downstream from the wastewater-treatment facility at Auburn and the confluence of Garrett ditch. Ammonia-nitrogen concentrations predicted for 1978 through 2000 downstream from the Waterloo wastewater-treatment facility do not exceed Indiana water-quality standards for streams. Calculations of the stream's assimilative capacity indicate that future waste discharge in the Cedar Creek basin will be limited to the reaches between the Auburn wastewater-treatment facility and County Road 68. (Kosco-USGS)
W80-05302

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR WILDCAT CREEK, HOWARD COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
C. G. Crawford, W. G. Wilber, and J. G. Peters.
Available from: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $8.50, Microfiche $3.50. Geological Survey open-file report 79-1252, July 1979. 60 p, 19 Fig, 13 Tab, 53 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilation capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Effluents, Forecasting, Water quality standards, Water pollution, Waste water disposal, Mathematical models, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, *Howard County(Ind), *Wildcat Creek(Ind).

The Indiana State Board of Health is developing a water-quality management plan that includes establishing limits for wastewater effluents discharged into Indiana streams. A digital model calibrated to conditions in Wildcat Creek was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. The model indicates that benthic-oxygen demand is the most significant factor affecting the dissolved-oxygen concentrations in Wildcat Creek during summer low flows. The Indiana stream dissolved-oxygen standard should not be violated if the Kokomo wastewater-treatment facility meets its current National Pollution Discharge Elimination System permit restrictions (average monthly 5-day biochemical-oxygen demand of 5 milligrams per liter and maximum weekly 5-day biochemical-oxygen demand of 7.5 milligrams per liter) and benthic-oxygen demand becomes negligible. Ammonia-nitrogen toxicity may also be a water-quality limitation in Wildcat Creek. Ammonia-nitrogen waste loads for the Kokomo wastewater-treatment facility, projected by the Indiana State Board of Health, will result in stream ammonia-nitrogen concentrations that exceed the State standard (2.5 milligrams per liter during summer months and 4.0 milligrams per liter during winter months). (Kosco-USGS)
W80-05303

U.S. HEAVY METAL LOADINGS TO THE GREAT LAKES: ESTIMATES OF POINT AND NONPOINT CONTRIBUTIONS,
Great Lakes Basin Commission, Ann Arbor, MI.
For primary bibliographic entry see Field 6A.
W80-05335

DATA PROCESSING AND ANALYSIS FROM H-F RADAR DATA OBTAINED IN COOK INLET ALASKA DURING SUMMERS 1977 AND 1978,
National Oceanic and Atmospheric Administration, Rockville, MD. Wave Propagation Lab.
For primary bibliographic entry see Field 5A.
W80-05337

A NEW TECHNIQUE FOR MEASURING TIDAL CURRENTS USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Rockville, MD. Wave Propagation Lab.
For primary bibliographic entry see Field 5A.
W80-05338

THE INTERACTION OF OIL WITH SEA ICE IN THE ARCTIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-05340

DYNAMICS OF NEAR-SHORE ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5A.
W80-05341

CURRENT MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-05342

NORTHWEST GULF OF ALASKA SHELF CIRCULATION,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05343

BRISTOL BAY OCEANOGRAPHIC PROCESSES (B-BOP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05344

CIRCULATION AND WATER MASSES IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5A.
W80-05345

NEAR-SHORE METEOROLOGY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05346

OBSERVATIONS OF MESOSCALE WINDS IN LOWER COOK INLET, ALASKA - MARCH 1978,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05347

THE RESPONSE OF COASTAL WINDS AT ALBATROSS BANKS, LOWER COOK INLET, AND HINCHINBROOK ENTRANCE TO A PASSING SYNOPTIC DISTURBANCE - PRELIMINARY ANALYSIS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W80-05348

BOTTOM AND NEAR-BOTTOM SEDIMENT DYNAMICS IN LOWER COOK INLET,
Geological Survey, Menlo Park, CA. Branch of Pacific-Arctic Marine Geology.
D. A. Cacchione, and D. E. Drake.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 505-546, October 1979. 13 Fig, 3 Tab, 14 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sediment transport, *Erosion, *Sand waves, Hazards, Environmental effects, Oil pollution, Offshore platforms, Resources development, Alaska, Paths of pollutants, *Outer Continental Shelf, Cook Inlet, Petroleum development.

An intensive field investigation was carried out on near-bottom and bottom sediment movement within a small area of lower Cook Inlet that contains bedforms of multiple scales. This research effort focuses on the mechanisms which control the transport of sediments, the temporal variability of this transport and the contrasts in transport at trough and crest locations of the largest bed features. The major objective, to provide a spatial and temporal description of bottom sediment movement in this highly complex sand wave environment, was motivated by the need to assess the potential environmental hazards posed by excessive erosion and sand wave migration. High rates of sediment transport and erosion are potentially hazardous to sea floor installations. Additionally, waste materials introduced into the bottom environment by drilling operations and oil spilled during recovery accidents will be in part transported by the bottom currents. If oil-contaminated sediments are effectively transported large distances along the bottom, and resuspended well up into the overlying water column, the spatial extent of harmful effects from these pollutants could be considerably greater than otherwise anticipated. (Sinha-OEIS)
W80-05349

MODELING OF TIDES AND CIRCULATIONS OF THE BERING SEA,
Rand Corp., Santa Monica, CA.
For primary bibliographic entry see Field 5A.
W80-05350

METEOROLOGY OF THE ALASKAN ARCTIC COAST,
Washington Univ., Seattle. Polar Science Center.
For primary bibliographic entry see Field 5C.
W80-05351

COMPARISON BETWEEN GEOSTROPHIC WINDS DERIVED FROM THE STANDARD PRESSURE MEASUREMENT NETWORK AND THE AIDJEX NETWORK,
Washington Univ., Seattle. Polar Science Center.
For primary bibliographic entry see Field 5A.
W80-05352

OIL POOLING UNDER SEA ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5A.
W80-05356

THE TRANSPORT AND BEHAVIOR OF OIL SPILLED IN AND UNDER SEA ICE,
Flow Research Co., Kent, WA.
For primary bibliographic entry see Field 5A.
W80-05357

BEAUFORT AND CHUKCHI SEA ICE MOTION. PART 1: PACK ICE TRAJECTORIES,
Flow Research Co., Kent, WA.
For primary bibliographic entry see Field 5A.
W80-05358

BEAUFORT AND CHUKCHI SEA ICE MOTION. PART 2: ONSET OF LARGE SCALE CHUKCHI SEA ICE BREAKOUT,
Flow Research Co., Kent, WA.
For primary bibliographic entry see Field 5A.
W80-05359

ICE BREAKOUT IN THE BERING STRAIT,
Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
For primary bibliographic entry see Field 5A.
W80-05360

ARCTIC OIL SPILL SCENARIOS - OUTLINE,
Flow Research Co., Kent, WA.
For primary bibliographic entry see Field 5A.
W80-05361

THE TRANSPORT AND BEHAVIOR OF OIL SPILLED IN AND UNDER SEA ICE - TASK 1,
ARCTEC, Inc., Columbia, MD.
For primary bibliographic entry see Field 5A.
W80-05362

ENERGY FACILITY SITING IN THE URBAN COASTAL ZONE: COMPATIBLE OR NOT,
Princeton Univ., NJ.
For primary bibliographic entry see Field 6E.
W80-05365

FEDERAL CONTROL OF WATER POLLUTION - AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE,
Levine and Krom, Beverly Hills.
For primary bibliographic entry see Field 6E.
W80-05374

LIQUEFIED NATURAL GAS TERMINAL SITING IN THE CALIFORNIA COASTAL ZONE: THE SCOPE OF PERMISSIBLE STATE AUTHORITY,
For primary bibliographic entry see Field 6E.
W80-05383

5C. Effects Of Pollution

LIFE CYCLE, ECOLOGY, AND MANAGEMENT CONSIDERATIONS OF THE GREEN FILAMENTOUS ALGA, PITHOPHORA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
C. A. Lembi, N. L. Pearlmutter, and D. F. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185333, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 130, April 1980. 97 p, 46 Fig, 23 Tab, 87 Ref. OWRT B-081-IND(2).

Descriptors: *Pithophora, *Life cycles, *Aquatic algae, *Akinetes, Cladophora, Aquatic weed control, Copper sulphate, Ecology, Filamentous alga, Spores.

Pithophora, a green filamentous, spore-forming alga in the order Cladophorales, forms infestations of thick free-floating mats in small impoundments, shallow lakes, and coves and channels of larger lakes and reservoirs throughout the midwest and southeastern United States. The purpose of the research was to obtain data on the biology of Pithophora in order to establish a basis for management recommendations. The life cycle of Pithophora oedogonia consists of two stages: branching filamentous cells and akinetes. Both cell types are enclosed by a thick cell wall composed primarily of cellulose with additional amounts of sugars, amino sugars, and proteins, the latter being concentrated in the outer cell wall layer. Chiten comprises 6 percent of the cell wall by weight and is localized in the outer wall layers, cross wall disks and associated bands. Akinetes that form in the free floating mats in the fall reach their highest number in the winter, and germinate at 20C water temperature. Akinete formation is probably due to nitrogen depletion rather than cold temperature, are high in number in the hydrosoil and retain viability to depths of 10 cm. in the hydrosoil. Specific management techniques for control of Pithophora are being studied and will be reported in a subsequent publication. (Wiersma-Ind)
W80-05101

NITROGEN AND PHOSPHORUS HYDROCHEMISTRY IN LAS VEGAS WASH,
Nevada Univ. System, Reno. Water Resources Center.
A. Schmidt, and J. W. Hess.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185325, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41063, March 1980. 71 p, 4 Fig, 7 Tab, 31 Ref, 5 Append. OWRT A-082NEV(1).

Descriptors: *Nitrogen, *Phosphorus, *Groundwater movement, *Nutrients, Urbanization, Test wells, Water levels, Water pollution, Waste water(Pollution), Aquatic plants, Water sampling, Bottom sediments, Eutrophication, Lake Mead.

The sources of nitrogen and phosphorus nutrient species, the chemical reactions occurring, and the parameters of nutrient uptake were studied for the Las Vegas Wash hydrologic system. Las Vegas

Wash, a natural drainage channel running from Las Vegas Valley to Lake Mead-Colorado River, has been the site of extensive urbanization in the past 20 years. The waste water increases associated with this development resulted in declining surface and groundwater quality and eutrophication of the Lake. Stricter effluent nutrient concentration standards were imposed and the effect of these standards is assessed. Water level measurements were taken in 14 wells in the area using a hand-held tape measure. Changes in water levels from the summer of 1975 to the summer of 1978 were determined. No area-wide improvement in shallow groundwater quality was found but several wells did indicate slow improvement. The wash was divided into two reaches to study flow budgeting. Results show that the inflow of groundwater above Pabco Road (Reach 1) is nearly zero while inflow below Pabco Road (Reach 2) is approximately 20 cfs. Salt input to Reach 1 has decreased while input to Reach 2 has remained constant. Also it appears that aquatic vegetation or bottom sediments in Reach 2 are accumulating P04(-3). Surface water quality has shown gradual improvement. (Seigler-IPA)
W80-05107

MODEL PREDICTIONS OF EFFECTS OF IMPOUNDMENT ON PARTICULATE ORGANIC MATTER TRANSPORT IN A RIVER SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 2J.
W80-05116

VERIFICATION OF A YORK RIVER ECOSYSTEM MODEL,
Virginia Inst. of Marine Science, Gloucester Point.
P. V. Hyer.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 246-252, 1978. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Estuaries, *Ecosystems, *Nutrients, *Model studies, Mathematical models, Biochemistry, Phytoplankton, Phosphorus, Nitrogen, Ammonia, Chlorophyll, Algae, Light, Photosynthesis, Water pollution, Water quality, Water pollution effects, Water pollution sources, *York River(VA).

The York River is a tidal estuary in a rural setting, where the chief occupations are farming, logging, and commercial fishing. Precipitation is lowest in September to January and highest in July and August, when thunderstorms abound. These storms, however, contribute relatively little runoff. The water temperature reaches 28C and sometimes 30C in late summer, but ice forms in about one winter out of every two. Summer is the critical time for water quality. The York is more than two miles wide in places, and its greatest depth approaches 30 meters. Therefore, a quasi three-dimensional model was decided on, with three lateral segments and two layers per reach. Observed chlorophyll concentrations ranged from 4-10 micrograms per liter, well below nuisance levels. It was found that arbitrarily doubling or tripling nutrient loadings input to the model could not trigger a bloom. Light was the most important factor controlling phytoplankton growth, followed by nitrogen availability. Oxygen levels were above five parts per million except in the deeper layer near the mouth, where a relatively stagnant region was created and oxygen concentration fell to about two parts per million. This natural phenomenon is not affected by point or nonpoint sources. (See also W80-05159) (Sims-ISWS)
W80-05180

SIMULATION OF ALGAL GROWTH IN THE CHOWAN RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
D. N. Contractor.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 253-264, 1978. 8 Fig, 7 Ref.

Descriptors: *Algae, *Rivers, *Virginia, *North Carolina, *Model studies, Mathematical models, Nitrogen, Nutrients, Ammonia, Oxygen, Biochemical oxygen demand, Chemical oxygen demand, Water quality, Water pollution, Water pollution effects, *Chowan River(VA, NC).

The Chowan River watershed lies in the southeastern part of Virginia. The Blackwater and Nottoway rivers form a confluence at the state line with North Carolina. The Meherrin River joins the Chowan River in a second confluence a few miles downstream of the first confluence. In the early 1970s, severe algal blooms occurred in the lower reaches of the Chowan River. A cooperative study of algal growth in the river was initiated in 1974. This paper presented some results of the mathematical model developed for the watershed above Holiday Island. (See also W80-05159) (Sims-ISWS)
W80-05181

THE STOCHASTIC VARIATION OF INSTREAM VALUES IN RIVERS,
Washington State Dept. of Ecology, Olympia.
R. T. Milhous, and K. D. Bovee.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 630-637, 1978. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Aquatic environment, *Mathematical models, *Habitat improvement, *Rivers, Stochastic processes, Fisheries, Water quality, Velocity, Analytical techniques, Water utilization, Statistical methods, Probability, Water temperature, Artificial substrates, Depth, Chinook salmon, Instream values.

An important part of the management of water resources is the allocation of water between out-of-stream uses and instream uses. In the context used, instream uses are all uses of water in the stream channel, except the production of hydroelectric power, with special attention given to the recreation and fisheries use of water instream. At this time very little work on instream flows has been done which describes the variation of the instream habitat over time; consequently, the information in this paper is incomplete and more in the nature of what could be done instead of what has been done. Ideas were presented as just that--ideas which can either be rejected in total, modified or expanded upon as an attempt is made to apply the concepts of stochastic process to instream flow-produced benefits. The use of statistics and stochastic approaches was in two areas: (1) the development of functional relationships between physical properties of streamflow and the biologic needs of a species of fish or a type of water-based recreation, and (2) the variation of the quality of the habitat over time. It was suggested that by combining a stochastic habitat model, as a driving variable for density dependence, with a population model, the observed variation in natural population of fish in a stream can be simulated. (See also W80-05159) (Humphreys-ISWS)
W80-05217

GROWTH AND PRIMARY PRODUCTIVITY OF MARINE MACROPHYTES EXPOSED TO DOMESTIC SEWAGE EFFLUENTS,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
A. C. Kindig, and M. M. Littler.
Marine Environmental Research, Vol 3, p 81-100, 1980. 7 Fig, 4 Tab, 26 Ref. OWRT A-054-CAL(11).

Descriptors: *Marine algae, *Growth rates, *Sewage effluents, Primary productivity, Domestic wastes, Primary treatment, Secondary treatment, Chlorination, Metabolism, Adaptation, Biomass, Photosynthesis, *Bossiella, *Lithothrix, *Corallina, *Amphiroa, *Acclimation.

This study provides the first response data for ten Southern California macrophytes exposed to untreated, primary, secondary and secondary chlorinated sewage effluent during long-term culture studies in the laboratory as well as short-term metabolic studies in the field and in the laboratory. Bossiella orbigniana, Lithothrix aspergillum and Corallina officinalis had relatively broad homeostatic capabilities and enhanced net production rates when exposed to primary treated sewage. In the long-term cultures, Amphiroa zonata, B. orbigniana and C. officinalis all demonstrated enhanced growth in the presence of primary sewage. Chlorination of effluent had only a short-term negative effect; i.e. species' responses to secondary and secondary chlorinated sewage were virtually identical beyond the second week in culture. Three populations of C. officinalis var. chilensis with differing pollution histories showed a tolerance to sewage corresponding to the extent of previous exposure, indicating that this species may be able to acclimate physiologically to sewage stress. The more sewage-tolerant macrophytes displayed lower photosynthetic quotient values during exposure to effluent than those possessing little tolerance to sewage. (Deal-ISWS)
W80-05250

THE FISH COMMUNITY OF LAKE SUPERIOR,
Ontario Ministry of Natural Resources, Maple. Fish and Wildlife Research Branch.
A. H. Lawrie.
Journal of Great Lakes Research, Vol 4, No 3-4, p 513-549, December 1978. 11 Fig, 18 Tab, 137 Ref, 1 Append.

Descriptors: *Lake Superior, *Fish, *Lake fisheries, *Surveys, Lakes, Fish populations, Lake Trout, Fish harvest, Salmon, Fish management, Lampreys, Fish establishment, Water pollution, Freshwater fish, Data collections, Lake Whitefish.

Lake trout, lake whitefish, and their relatives characterize the fish community of oligotrophic Lake Superior. That community has been substantially altered by the direct and indirect effects of man's activities, generally in the direction of reduced diversity and depletion of many fish stocks. Long-continued heavy fishing, predation by and competition from invading exotic species, and environmental degradation have all played a role as have efforts to rehabilitate the community by introducing hatchery-reared fish of desired species. Community responses to these influences have been complex, and although some are obvious and can be quantitatively modeled others reflect subtler, interactive responses to primary changes in abundance and size composition of various components of the community. Among the stresses whose roles remain to be clearly defined are the anthropogenic contaminants now known to occur, if only in small concentrations, in virtually all species. Although their impact on the welfare of individual fish stocks cannot be precisely defined at the moment, their presence at all is profoundly disturbing. (Humphreys-ISWS)
W80-05266

GROWTH, CHLOROPHYLL AND MINERAL NUTRIENT STUDIES ON PHALARIS ARUNDINACEAE L. IN THREE SCOTTISH LOCHS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-05319

INVASION, POPULATION DYNAMICS AND ELEMENTAL ACCUMULATION OF CORBICULA FLUMINEA IN THE NEW RIVER AT GLEN LYN, VIRGINIA,
East Tennessee State Univ., Johnson City. Dept. of Environmental Health.
J. H. Rodgers, Jr., D. S. Cherry, K. L. Dickson, and J. Cairns, Jr.
In: Proceedings, First International Corbicula Symposium Texas Christian University, Fort Worth, October 13-15, 1977. p 99-110 (1977). 4 Fig, 2 Tab, 27 Ref. OWRT B-101-VA(2).

Descriptors: *Toxicity, Population dynamics, Bioassays, *Invasion, Mercury, Arsenic, Selenium, *Heated water, *Powerplants, Virginia, Invasion rate, Corbicula, *Asiatic Clam, Bioaccumulation, *New River(VA), *Glen Lyn(VA).

Corbicula fluminea has apparently successfully invaded the New River, and population densities of about 1,000 individuals per square meter have become established after three years. The influence of thermal effluent from a coal-fired power plant on population numbers was observed after an unusually cold winter had caused a severe decline in density in areas unaffected by heated water. Numbers remained essentially constant in the thermal effluent during the winter months. After the following spawning season, population densities outside of the thermal effluent recouped, although size classes were altered. Bioaccumulation of elements in soft body parts of Corbicula was generally intermediate in comparison to sediment and water. Of several potentially toxic elements, only selenium, mercury, and arsenic were found in soft body tissues in concentrations of less than 1 ppm. (Cherry-Virginia)
W80-05332

EXPERIMENTS IN RECYCLING SWINE MANURE IN FISHPONDS,
Illinois Natural History Survey Kinmundy.
D. H. Buck, R. J. Baur, and C. R. Rose.
Food and Agriculture Organization of the United Nations, Rome, Italy. Paper FIR: AQ/Conf/76/E 29, February 1976, 5 p. OWRT A-083-ILL(2).

Descriptors: *Swine manure, *Recycling, *Fish farming, *Fish, *Waste treatment, *Aguiculture, *Farm wastes, Waste management, *Buffalo fish, Chinese carps, Polyculture.

This is believed to have been the first attempt in North America to utilize certain Asian cultures and techniques in the solution of such problems as animal waste management, pollution control, and the production of protein. Two small Illinois ponds of similar size received nearly identical stockings of fish (three Chinese carps, common carp, largemouth bass, a hybrid buffalo fish and channel catfish), but differing amounts of swine manure. One pond (0.127 ha) received the total wastes from five growing pigs (about 39 pigs/ha of water area), the other pond (0.121 ha) received the wastes from eight pigs (66 pigs/ha). Two consecutive lots of pigs were fattened during the experiment. Water levels were lowered at mid-season to improve natural circulation, but conditions were otherwise static, with no artificial circulation or aeration. Over a fish-growing period of about 170 days (May to October 1975) the net increments in fish biomass were at the rates of 2971 kg/ha in the 0.127-ha pond, and 3834 kg/ha in the 0.121-ha pond. The high production of fish was attributed to: (1) the high quality of the swine rations; (2) an efficient density of stocking ratio of fish species; and (3) effective water level management. A beneficial influence by the fish population on water quality was indicated by continuously adequate levels of dissolved oxygen, and final BODs in the range of 8-12 mg/l.
W80-05333

OIL SPILL VULNERABILITY, COASTAL MORPHOLOGY, AND SEDIMENTATION OF KOTZEBUE SOUND,
South Carolina Univ., Columbia. Div. of Coastal Research.
M. O. Hayes, and C. Ruby.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VII, Transport, p 115-170, October 1979. 9 Fig, 5 Tab, 15 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, *Baseline studies, Path of pollutants, Sedimentation, Exploration, Movement, Alaska, Resources development, *Outer Continental Shelf, Coastal morphology, Vulnerability index, Kotzebue Sound(AK).

The potential for oil spills in Alaskan waters is increasing as exploration and development continue to escalate. There is a complex interaction of marine processes during an oil spill which can make it extremely difficult to predict the track and dispersal pattern of an oil spill. However, numerous case studies permit the construction of an oil spill vulnerability scale which is based primarily on the longevity of spilled oil within each geomorphic environment, and the biologic sensitivity and natural cleaning ability of those environments. This scale is here modified for Kotzebue Sound. The scale has been devised on the basis of case studies and a careful study of the literature, and is based primarily on the longevity of oil in each subenvironment, which is generally a function of the intensity of the marine processes, sediment size and transport trends. The biologic sensitivity has also been utilized to modify the ratings of the various environments. Coastal environments are listed and discussed in order of increasing vulnerability of oil spills. (Sinha-OEIS)
W80-05339

METEOROLOGY OF THE ALASKAN ARCTIC COAST,
Washington Univ., Seattle. Polar Science Center.
T. L. Kozo, and R. A. Brown.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 1-45, October 1979. 28 Fig, 20 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-67.

Descriptors: *Meteorology, *Winds, *Baseline studies, *Ice, Water pollution effects, Environmental effects, Resources development, Alaska, Arctic, Path of pollutants, Coasts, *Outer Continental Shelf, Petroleum development.

Surface winds, temperature and atmospheric pressures along the Alaskan arctic coast were measured and analyzed to derive the wind field responsible for near shore (water depths to 20 m) surface water movement. Results of this study have shown that the surface wind field in spring and summer is strongly correlated at measuring stations separated by distances up to 100 km. This strong mesoscale correlation implies that a minimum of surface wind measurements points could provide a reasonable data set for coastal current trajectory studies. The effect of coastal winds on the summer nearshore circulation has relevance to transport of detritus, biota, spilled oil, and small ice floes. The sea breeze promotes barrier island lagoon flushing, and upwelling by maintaining persistent NE to E surface winds. Any attempt to predict current trajectories must include a prediction of the surface wind field. The summer main ice pack edge serves as a source for small ice floes which are driven into the nearshore region by surface wind and resultant currents. Uncovered sea bed pipelines in trenches running from the offshore islands to the coast will be susceptible to ice damage when floes move into shallow water with a northerly velocity component. Oil slicks that may result from such accidents will also be strongly influenced by the wind regime. (Sinha-OEIS)
W80-05351

CHARACTERIZATION OF THE NEARSHORE HYDRODYNAMICS OF AN ARCTIC BARRIER ISLAND-LAGOON SYSTEM,
Alaska Univ., Fairbanks. Geophysical Inst.
J. B. Matthews.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 57-97, October 1979. 19 Fig. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Hydrodynamics, *Circulation, *Water quality, Barrier islands, Lagoons, Oil pollution, Water pollution effects, Environmental effects, Baseline studies, Resources development, Arctic, Alaska, Ecosystems, Lagoons, Marine environment, *Outer Continental Shelf, Petroleum development, Environmental impact.

This project provides sea level, temperature, salinity, current speed and direction data for stations within the proposed Beaufort Sea lease area. The lagoon waters are wind-driven in the open water season with currents in the same direction as the wind and with 3% the wind speed. Winds of 12 m/sec during a storm resulted in observed currents in Simpson Lagoon of 40 cm/sec. The sea level changes were about 1 m due to wind set-up whereas tidal ranged are from 10-20 cm. Barometric pressure does not have much influence on sea level during the open water season. Currents under ice were generally less than 10 cm/sec. The overall ecosystem processes study addresses only those processes which are anticipated to be impacted by activities related to petroleum development. Water quality and circulation, during both the open-water and ice-covered seasons, are a primary driving mechanism of the ecosystem. Water quality influences biological growth and migration routes for fish. Water circulation can carry pollutants and nutrients and is influenced by man-made changes to the environment, such as building of causeways, drilling pads and pipelines. One must know the existing water quality and circulation before oil development begins in order to assess probable impacts resulting from such activities. (Sinha-OEIS)
W80-05353

SOURCES, TRANSPORT PATHWAYS, DEPOSITIONAL SITES AND DYNAMICS OF SEDIMENTS IN THE LAGOON AND SHALLOW MARINE REGION, NORTHERN ARCTIC ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
A. S. Naidu, and M. D. Sweeney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VIII, Transport, p 98-181, October 1979. 6 Fig, 17 Tab, 36 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Sediment transport, *Heavy metals, Oil spills, *Ecosystems, Baseline studies, *Sedimentation, Resources development, Water pollution effects, Environmental effects, Arctic, Alaska, Lagoons, Marine environment, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The major objectives of this program are to understand the dynamics of sedimentation, to characterize benthic substrate habitats, and to elucidate the sources and depositional sites of terrigenous particles in the lagoon and adjacent shelf area of north arctic Alaska. Additional goals include completion of collection of baselines of a suite of heavy metals relative to sediments of the Beaufort Sea, understanding of the geochemical partitioning of the heavy metals in various sediment phases, and estimation of the rate of sedimentation. Compilation of all available data on textural attributes of surficial sediments of the Beaufort Sea has been completed. Maps generated to display regional variations in the gross lithology and the various statistical grain size parameters will be useful to biologists interested in characterizing the benthic habitats of the Beaufort Sea, as well as to geologists who are concerned with elucidation of Holocene depositional history of the Beaufort Sea. The baseline data on heavy metals in sediments should help in detection of any large scale perturbations in environments that might result from discharge of chemical pollutants into the nearshore areas. The baseline lithology maps should serve a useful purpose in detecting any changes in sediment budgets (and by implication benthic habitats) resulting from petroleum-related activities such as dredging, causeway construction and possible gravel/sand exploitation. (Sinha-OEIS)
W80-05354

5D. Waste Treatment Processes

EVALUATION OF MEMBRANE PROCESSES AND THEIR ROLE IN WASTEWATER RECLAMATION,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185754, Price codes: A12 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water Research and Technology, November 1979. 234 p. OWRT C-80159-R (No 8520)(1).

Descriptors: *Advanced wastewater treatment, *Water reuse, *Facilities, Water reclamation, Trace organics, Reverse osmosis, Demineralization, Biological treatment, Orange County Water District(California), Costs, Facilities, Design.

Water Factory 21 (WF-21) in Orange County, California, is a 15 mgd advanced wastewater treatment (AWT) plant designed to reclaim biologically treated municipal wastewater for injection into a seawater barrier system. Processes included are lime treatment, air stripping, filtration, activated carbon adsorption, reverse osmosis (RO), and chlorination. The effectiveness of each process is presented, with emphasis on demineralization, ozone and biologically activated carbon, and ultrafiltration. The data show that the combination of processes used at WF-21 is capable of producing a very high quality water. All contaminants were reduced below national interim primary drinking water regulation maximum contaminant levels at least 98% of the time. Over 100 trace organic substances were found in the influent to WF-21, and of these about 30 were regularly monitored. The two processes found most effective in removal of specific organics were air stripping and activated carbon adsorption. Overall removals generally exceeded 90%. Viruses were routinely found in WF-21 influent. On two occasions viruses were detected in the activated carbon effluent during upflow operation of the columns. Following modifications, no viruses have ever been found in the effluent from the activated carbon columns or that from the RO system. AWT cost at WF-21 is $665/mil gal and the additional cost of RO demineralization is $621/mil gal. These figures include all operation and maintenance costs as well as amortization of capital.
W80-05105

VIRUS REMOVAL BY ADVANCED WASTEWATER TREATMENT.
Orange County Water District, Fountain Valley, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-188386, Price codes: A09 in paper copy, A01 in microfiche. Final Report, Prepared for the Office of Water Research and Technology, October 1979. 139 p, 36 Fig, 60 Tab, 45 Ref, 5 Append. OWRT C-80159-R (No 8520)(2), 14-34-0001-8520.

Descriptors: *Viruses, *Waste water treatment, *Chlorination, *Reverse osmosis, Lime, Aluminum, California, Activated carbon, Water purification, Assay, Analytical techniques, Sewage effluents, Diseases, Public health, Orange County Water District(Cal).

An enteric virus monitoring program was performed during 1975-1979 at Water Factory 21 in the Orange County Water District in California to develop sensitive quantitative determination methods for enteric viruses, to monitor the plant's chlorinated effluent for enteric viruses, and to evaluate the effectiveness of the plant's individual unit processes. Water Factory 21 represents the state-of-the-art technology in water reclamation and incorporates a 5 mgd reverse osmosis plant. Eleven experiments were performed to develop an optimized methodology for concentrating enteric viruses from plant effluents. An adsorption procedure was selected that involves adjusting the sample to a pH of 3.5 and adding Al(III). The Filterite filter, found to be the best of four studied adsorbents, was used in calibration tests at the various sites to determine the volume that could be processes by the adsorbent. The liquid culture assay system using cytopathic effects with Buffalo Green monkey kidney cells and human carcinoma cells was found to recover the largest number of isolates. Assays were performed on 207 samples from various treatment processes. Lime treatment was found to have a 98 to 99.9% removal capability. No positive samples were found in the reverse osmosis influent or effluent or in the granular activated carbon unit. Of 122 chlorinated effluent samples assayed, 2 were positive and both were associated with atypical operating conditions. (Seigler-IPA)
W80-05106

WASTEWATER TREATMENT IN COLD REGIONS BY OVERLAND FLOW,
Cold Regions Research and Engineering Lab., Hanover, NH.
C. J. Martel, T. F. Jenkins, and A. J. Palazzo.
CRREL Report 80-7, February 1980. 18 p, 6 Fig, 10 Tab, 16 Ref.

Descriptors: *Cold regions, *Overland flow, *Waste water treatment, Sewage treatment, Biochemical oxygen demand, Seasonal, Winter, Forages, New Hampshire, Subsurface runoff, Water pollution, Snowmelt, Nitrogen, Water storage.

Three types of water, primary effluent, secondary effluent, and tapwater, were applied to separate sections of a pilot-scale overland flow site in Hanover, New Hampshire, to evaluate the performance of overland flow waste water treatment in cold regions. The study area has a mean annual temperature of 7C and the temperature falls below 0C approximately 160 days/year. The test site was 30.5 m long, 8.8 m wide, with a 5% slope. Primary and secondary waste water were obtained from pilot plant units and tapwater was supplied by the Hanover water supply system. Applications were made daily at 0.25 cm/hr for an average weekly application rate of 5 cm/week. Measurements were taken for one year of surface runoff, subsurface flows, precipitation, evaporation, percolation, soil temperature, and meteorological parameters. Results show that overland flow is a successful treatment method for primary and secondary effluent during all seasons of the year except winter. Runoff from the primary section exceeded the 30-mg/liter BOD standard for 82 days during winter, however, runoff from the secondary section did meet standards for the same period. The tapwater section, used as a control, showed no pollutants. Nitrate was the most difficult form of nitrogen to remove while ammonia was the easiest. Excellent forage yield was observed for both of the waste water sections and winter applications caused only minor injury. Storage prediction times from the EPA-1 computer program appear to be adequate. (Seigler-IPA)
W80-05112

ULTRAFILTRATION TREATMENT OF POULTRY PROCESSING WASTEWATER AND RECOVERY OF A NUTRITIONAL BY-PRODUCT,
North Carolina State Univ. at Raleigh. Dept. of Poultry Science.
J. C. H. Shih, and M. B. Kozink.
Poultry Science, Vol 59, No 2, p 247-252, Feb 1980. 4 Fig, 3 Tab, 12 Ref. OWRT A-100-NC(2), 14-34-0001-8035.

Descriptors: *Poultry processing, Water reuse, By-product recovery, Membrane flux, *Waste water treatment, *Industrial wastes, Wastewater reuse, Membrane ultrafilter, Poultry industry.

A lab-scale membrane ultrafilter was constructed with one pair of tubular membranes, a circulation pump, and a storage tank. It was devised to treat the poultry processing wastewater in the laboratory and, simultaneously, to recover a by-product which was found to have nutritional value for its protein and fat contents. The wastewater collected from the poultry processing plant was circulating at 2.8 kg/cm2 (40 psi) and 57 liter/min (15 gal/min) around the membrane to perform an average membrane flux of 407 liter/day/m2 (10 gal/day/ft2). The original wastewater and the resulted permeate and concentrate were analyzed for chemical oxygen demand (COD), total solids (TS), nitrogen, fat and protein. The permeate, which contained only 240 mg/liter TS and 131 mg/liter COD, was believed to be safe for direct discharge or potential reuse. The by-product, which was generated from the drying of the concentrate, contained 30 to 35% of true protein and 24 to 45% of fat. The chemical score based on amino acid analysis was comparable to that of soybean protein. The results indicated that this new method may have great potential for application to the treatment of poultry processing wastewater. The by-product with its nutritional value could make it possible to generate an economic return for the processing industry to reclaim the operating cost and, perhaps, a part of the facility investment. (Kiger-North Carolina)
W80-05330

PHOSPHORUS CONTROL STRATEGIES AT MUNICIPAL WASTEWATER TREATMENT PLANTS IN THE U.S. GREAT LAKES BASIN,
Great Lakes Basin Commission, Ann Arbor, MI.
T. J. Monteith, R. A. Sullivan, and W. C. Sonzogni.
Great Lakes Environmental Planning Study, Contribution No 14, February 1980. 38 p, 12 Tab, 24 Ref.

Descriptors: *Phosphorus, *Sewage treatment, *Great Lakes, *Phosphorus removal, Detergent control, Great Lakes Environmental Planning Study, State phosphorus control programs, Point source inputs, Phosphorus loads, Municipal discharges.

Discharges from municipal wastewater treatment plants are the major source of total phosphorus (P) entering the Great Lakes. This report documents the current status of municipal P control programs in the Great Lakes basin. Thus, state policy on reducing P from municipal wastewater treatment plants within the Great Lakes basin and the present rate of compliance with this policy was examined. Information on the current technologies in use for controlling P at municipal wastewater treatment plants was also compiled. Finally, reductions in municipal P loads to surface water are presented. Each of the eight Great Lakes states has established P effluent limitations for sewage treatment plants. All plants discharging to Great Lakes surface waters, with a design flow of 1 million gallons per day (mgd) or greater, must limit the total P concentration in their effluent to 1 milligram per liter (mg/l). Most of the plants in the U.S. basin with P removal utilize a chemical precipitation process. Some use land application and others use tertiary advanced treatment processes, such as chemical treatment followed by special filtration. Five of the Great Lakes states currently limit P content to 0.5% by weight in home laundry detergents. Limiting P in these detergents is designed to reduce the amount of P entering municipal plants and reduce P discharges from combined sewer overflows.
W80-05336

FEDERAL CONTROL OF WATER POLLUTION - AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE,
Levine and Krom, Beverly Hills.
For primary bibliographic entry see Field 6E.
W80-05374

5E. Ultimate Disposal Of Wastes

LIMESTONE LINER FOR LANDFILL LEACHATES CONTAINING BERYLLIUM, CADMIUM, IRON, NICKEL, AND ZINC,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
J. Artiola, and W. H. Fuller.
Soil Science, Vol 129, No 3, p 167-179, March 1980. 6 Fig, 5 Tab, 33 Ref.

Descriptors: *Landfills, *Linings, *Limestones, *Leachate, *Heavy metals, Beryllium, Cadmium, Iron, Nickel, Zinc, Soil chemistry, Movement, Ion transport, Laboratory tests, Soils, Solid wastes,

Waste disposal, Adsorption, Ion exchange, Flue gas scrubbing.

The influence of crushed agricultural limestone, placed in a layer over six soils, on the rate of migration of beryllium, cadmium, iron, nickel, and zinc contained in municipal, solid-waste, landfill leachate, was evaluated. The limestone was highly effective in slowing the rate of migration of beryllium, cadmium, nickel, and zinc in all six soils, which represent five major soil orders of the United States. Not only breakthrough (C/C sub 0 = 0.5) but also final breakthrough (C/C sub 0 = 1) values were significantly delayed (twofold to threefold) over soil alone. The limestone effect was considerably more than additive, i.e., several times more than the sum of soil alone plus limestone alone. The limestone effects were not the same for the individual metals. Attenuation effects were greatest for beryllium and least for cadmium. The migration rate of iron, indigenous to the landfill leachate, also was favorably slowed by the limestone barrier layered over the soils. (Visocky-ISWS)
W80-05137

HAWAIIAN WASTE INJECTION PRACTICES AND PROBLEMS,
Hawaii Univ., Honolulu. Water Resources Research Center.
S. Petty, and F. L. Peterson.
Technical Report No 123, January 1979. 104 p, 3 Tab, 4 Fig.

Descriptors: *Waste disposal wells, *Injection wells, *Sewage effluents, Clogging, Suspended solids, Microorganisms, Hawaii, Construction, Evaluation, *Ghyben-Herzberg lens, Rehabilitation, Oahu, Maui, Kauai.

In recent years in Hawaii numerous shallow waste injection wells, constructed for the disposal of domestic sewage effluent, have failed to operate as designed. A field reconnaissance of all the known waste injection wells on Oahu and Kauai, and approximately half of those on Maui, was made and their methods of operation and injection problems evaluated. The results of this study indicate that injection well problems are primarily due to physical and biological, and probably to a much lesser extent, chemical clogging phenomena at the well face. The clogging in a large part results from improper treatment plant operation, improper injection well operation and maintenance, and poor well site selection. Improper well construction practices also contribute to a much lesser degree. Furthermore, the results of this study indicate that inadequate data collection, both prior to and after injection has begun, makes early detection and solution of the injection problems more difficult. Recommendations for more adequate data collection and treatment plant and injection well operation and maintenance are made which hopefully will avoid or at least alleviate many of the injection well problems encountered in this study.
W80-05157

THE SILURIAN SALT DEPOSITS IN EASTERN LAKE, NORTHWESTERN ASHTABULA, AND NORTHEASTERN GEAUGA COUNTIES, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
S. E. Norris.
Geological Survey open-file report 79-269, December 1978. 15 p, 8 Fig, 2 Tab, 2 Ref.

Descriptors: *Salts, *Ohio, *Aggregates, *Sedimentary rocks, *Carbonate rocks, Inorganic compounds, Sites, Drilling, Test wells, Subsurface investigations, *Radioactive waste disposal, *Silurian salt deposits, *Northeast Ohio.

Five salt zones, comprising single or multiple salt beds interbedded with dolomite, dolomitic shale and anhydrite, occur in a 250-square-mile area in eastern Lake, northwestern Ashtabula, and northeastern Geauga Counties, Ohio. The aggregate thickness of salt-bearing rocks, from the base of the lowest salt to the top of the highest salt, ranges from about 300 feet in the northern part of the area to more than 450 feet in the southern part. The aggregate thickness of salt, exclusive of the intervening rocks, also increases southward, from about 100 feet to more than 200 feet. The thickest salt bed, the F1A salt, is 35 to 38 feet thick in northeastern Geauga and southeastern Lake Counties. (Kosco-USGS)
W80-05295

5G. Water Quality Control

WATER QUALITY TRAP EFFICIENCY OF STORM WATER MANAGEMENT BASINS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Water Resources Bulletin, Vol 16, No 1, p 15-21, February 1980. 4 Fig, 7 Tab, 11 Ref.

Descriptors: *Detention reservoirs, *Water quality, *Urban runoff, *Water quality control, Water pollution, Water pollution sources, Water pollution control, Sediments, Chemicals, Pollutants, Urban hydrology, Storm runoff, Storage, Water management(Applied), On-Site investigations, Data collections, Biochemical oxygen demand, Chemical oxygen demand, Metals, Nutrients.

While the quality of rivers has received much attention, the degradation of small streams in upland areas of watersheds has only recently been recognized as a major problem. A major cause of the problem is increases in nonpoint source pollution that accompany urban expansion. A case study was used to examine the potential for storm water detention as a means of controlling water quality in streams of small watersheds. The storm water management basin, which is frequently used to control increases in discharge rates, can also be used to reduce the level of pollutants in inflow to receiving streams. Data collected on a 148-acre site in Maryland showed that a detention basin can trap as much as 98% of the pollutant in the inflow. For the 11 water quality parameters, most showed reductions of at least 60%, depending on storm characteristics. (Sims-ISWS)
W80-05139

INVESTIGATIONS OF SPARGING AS A METHOD FOR PROMOTING COOLING POND HEAT TRANSFER,
Argonne National Lab., IL. Atmospheric Physics Section.
For primary bibliographic entry see Field 2H.
W80-05152

AN EVALUATION OF ILLINOIS LAWS AND REGULATIONS RELATED TO THE QUALITY OF GROUND WATER.
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 6E.
W80-05154

OPTIMUM ALTERNATIVES FOR CONTROLLING COMBINED SEWAGE OVERFLOWS--A CASE STUDY,
Barr Engineering Co., Minneapolis, MN.
For primary bibliographic entry see Field 6B.
W80-05170

ON THE SCALING OF LABORATORY OXYGENATION STUDIES,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Wasserbau III.
M. Markofsky.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 801-810, 1978. 7 Fig, 7 Ref.

Descriptors: *Model studies, *Oxygenation, *Water quality control, *Reaeration, Hydraulic models, Dissolved oxygen, Reviews, Laboratory tests, Weirs, Data collections, Diffusion, Methodology, Open channel flow, Bubble curtains, Diffusers.

Literature and laboratory studies on artificial aeration were undertaken. The work was divided into three phases: (1) A literature study of weir aeration: This was undertaken because the large amount of laboratory and field data available in the literature enables, through dimensional analysis, a detailed investigation of model-prototype behavior to be made. (2) Experimental studies of diffused air aeration in flowing water using two-dimensional bubble curtains: In these studies systematic variations were made of the primary variables affecting aeration efficiency per unit depth, i.e., air flow rate per unit width, ambient water velocity, and type of diffuser. The laboratory results were compared with published laboratory and field data. (3) Experimental studies of diffused air aeration in stagnant water-model family: In three different diameter pipes in which water depths of up to 2.1 m could be obtained, the effect of model dimensions on aeration efficiency using single port diffusers was investigated. In these experiments the air flow rate, water depth, pipe diameter, and air port diameter were systematically varied. The ability to scale from smaller to larger pipe diameters was investigated thus yielding insight into model-prototype behavior. A nomogram was presented for the prediction of oxygen transfer as a function of the weir nappe Froude and Reynold's numbers. (See also W80-05159) (Humphreys-ISWS)
W80-05236

IRRIGATOR INVOLVEMENT IN THE IMPLEMENTATION OF AGRICULTURAL NONPOINT SOURCE POLLUTION CONTROL PROGRAMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. G. Evans, W. R. Walker, and G. V. Skogerboe.
Water Resources Bulletin, Vol 16, No 1, p 133-136, February 1980. 1 Fig, 1 Tab, 8 Ref. EPA R-804672.

Descriptors: *Irrigation, *Water pollution control, *On-site investigations, *Colorado, Salinity, Salts, Water pollution, Water pollution sources, Pollutants, Farm management, Irrigation practices, Water management(Applied), Water users, Agriculture, Nonpoint water pollution sources.

Recently, Congress designated irrigated agriculture under the 'nonpoint source' category covered by Section 208 of P.L. 92-500 and involves the use of 'best management practices.' Generally, the most appropriate solutions for pollution abatement from irrigated agriculture involve the delivery and use of water rather than the treatment of irrigation return flows: (1) Technological alternatives should be utilized that are sensitive to local conditions and acceptable to the farmers. (2) Informational and educational programs to assist farm operators individually and collectively must be instituted prior to the start of the project; imaginatively conceived, and continuously modified and upgraded if motivation for change is to be encouraged. (3) Technical assistance personnel should be given short courses in skills needed for working effectively with irrigators. (4) Communication techniques used for working with farmers as individuals and groups should be designed into the implementation program and evaluated. (5) Credibility and trustworthiness of federal and state agencies in the eyes of the irrigators provide the important final ingredient in effectively implementing change and reducing nonpoint source pollution from irrigated agriculture. (Sims-ISWS)
W80-05257

EPA SETS RULES ON HAZARDOUS WASTES,
R. J. Smith.
Science, Vol. 207, No. 4436, p 1188, March 14, 1980.

Descriptors: *Waste disposal, *Regulations, *Hazardous wastes, Waste treatment, Water pollution treatment, Waste storage, Costs, Repairing, Environmental Protection Agency.

The EPA has published final rules requiring that generators, transporters, and disposers of hazardous wastes maintain records detailing exactly where the wastes are going. The cost of the resul-

tant paperwork is expected to be between $16 and $24 million annually. The EPA will also designate specific hazardous wastes and establish waste treatment, storage and disposal standards. The total cost of implementing these regulations has been estimated at about $1 billion annually. The cost of repairing damage done by improper disposal is estimated at 444 billion. Neither the states nor the federal government can afford the repair cost and numerous owners of substandard waste sites have threatened to walk away from their properly if the new regulations cost too much. The EPA is proposing a cleanup 'super-fund' which will draw its revenues from an annual contribution of 4700 million from the chemical industry. The fund will be used to clean up waste sites where a responsible party cannot be determined. (Purdin-NWWA)
W80-05322

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

APPLICATIONS AND EVALUATION OF DECISION ANALYSIS IN WATER RESOURCES PLANNING,
Decision Science Consortium, Inc., Falls Church, VA.
D. A. Seaver, R. V. Brown, V. N. Campbell, J. W. Ulvila, and J. O. Chinnis, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185481, Price codes: A04 in paper copy, A01 in microfiche. Technical Report 79-2, Prepared for Office of Water Research and Technology, December 1979. 67 p, 35 Ref, Append. OWRT C-80054-P (No 8406)(1).

Descriptors: *Planning, *Decision making, *Decision analysis, Cost-benefit analysis, Water supply development, Evaluation, Water resources development, Computer models.

Decision analysis is a systematic way of structuring the considerations that enter into a planning or decision making problem. It facilitates the planning or decision making process primarily by enabling attention to be directed selectively at different components in a complex problem, and by properly integrating the various components. As such, decision analysis may offer a comprehensive, consistent framework for water resources planning that fills some existing methodological and practical gaps in current planning approaches. The work reported here was undertaken to explore the applicability of decision analysis to water resources planning. Our approach was to use decision analysis in two ongoing problems, working closely with the responsible planning authorities in each case. These applications, and an evaluation of the usefulness of decision analysis, are reported here. We also have provided some additional description of the general techniques and uses of decision analysis that potentially may be particularly appropriate for water resources planning. Our work indicates that decision analysis generally is seen as appropriate and useful by planners, and does offer some technical improvements for planning. However, many organizational and institutional constraints must be overcome to expand the actual use of decision analysis. Some suggestions are made as to how institutional acceptance may be gained.
W80-05104

WATER-MANAGEMENT PLANNING FOR ILLINOIS COMMUNITIES,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6B.
W80-05115

COMPUTATIONALLY EFFICIENT POLYNOMIAL APPROXIMATIONS USED TO PROGRAM THE THEIS EQUATION,
Wyoming Univ., Laramie. Dept. of Geology; and Wyoming Univ., Laramie. Water Resources Research Inst.
P. W. Huntoon.
Ground Water, Vol 18, No 2, p 134-136, March-April 1980. 7 Ref.

Descriptors: *Theis equation, *Aquifers, *Drawdown, *Recharge, *Model studies, Mathematical models, Computer models, Groundwater, Storage, Transmissivity, Pumping, Mathematics, Equations, Hydraulics, Hydrology, Hand calculator programs.

Polynomial approximations were developed for the infinite series embodied in the Theis equation. These have the following advantages when programmed for use on computers or hand calculators: (1) they are easy to program; (2) they are computationally efficient; and (3) they eliminate round-off errors. (Sims-ISWS)
W80-05121

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING AND INJECTION WELLS: II--CONSTANT PUMPING (INJECTION) RATE, SINGLE FULLY PENETRATING WELL, SEMICONFINED AQUIFER,
Missouri Univ. Rolla. Dept. of Geological Engineering.
D. L. Warner, and M. G. Yow.
Ground Water, Vol 18, No 2, p 126-133, March-April 1980. 3 Tab, 7 Ref, 2 Append. EPA R805039-01-1.

Descriptors: *Wells, *Pumping, *Injection wells, *Model studies, Mathematical models, Computer programs, Water wells, Oil wells, Aquifers, Pressure, Drawdown, Groundwater, Hydrology, Semiconfined aquifers, Hand calculator programs.

In a previous article, programmable calculator programs were given for the calculation of head or pressure changes resulting from the pumping of wells completely penetrating a fully confined aquifer. Aquifers are often only semiconfined. That is, they are confined by aquitards or leaky confining beds. Such aquifers are frequently referred to as leaky aquifers. In this article, programs were documented for the calculation of head or pressure change resulting from pumping from or injection into a semiconfined aquifer. The programs were for the Texas Instruments TI 59 card programmable calculator, and were given in water well and practical oilfield units. Listings of the programs were contained in the appendices. (Sims-ISWS)
W80-05122

MODELS AND METHODOLOGIES IN MULTIOBJECTIVE WATER RESOURCES PLANNING,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
D. M. Mades, and G. Tauxe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185952, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 150, February 1980. 98 p. OWRT B-105-ILL(4), 14-34-0001-7154.

Descriptors: *Multiple objectives, *Planning, *Water resources, Optimization, River basins, Water quality, Reservoirs, Models, *Systems analysis, Linear programming, Dynamic programming, Non-linear programming, *Model studies, Evaluation, *Mathematical models.

The number of mathematical models used to represent complex water resource systems has grown with the advent of high-speed computers and the validation of empirical hydrologic and hydraulic relations. At the same time, algorithms for solving mathematical decision-making models have also experienced rapid growth and development in the field of operations research. More recently, the planner has been forced to consider multiple objectives, which often conflict, in designing water resource systems. This report discusses the application of multiple objective optimization algorithms to water resources related problems. A very intensive survey of previous research in this area is summarized under the areas of river basin planning, water-quality management and reservoir management. Multi-objective or vector-valued optimization algorithms are reviewed as an extension of the earlier single objective optimization algorithms. An extension of classical dynamic programming was formulated during this study. Multiobjective dynamic programming was applied to several planning problems to illustrate its useful potential. The algorithm was used to generate trade-off functions for hypothetical and case reservoir studies and a stream water quality problem. This report represents a general overview of existing multi-objective water resources planning models. The general strengths and weaknesses of the various multi-objective optimization algorithms are briefly discussed. This report is intended to illustrate the usefulness of mathematical modelling in water resources planning.
W80-05156

A PLAN TO STUDY THE AQUIFER SYSTEM OF THE CENTRAL VALLEY OF CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. L. Bertoldi.
Available from: OFSS, Box 25425, Fed Ctr, Denver CO 80225. Price codes: $6.50 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1480, October 1979. 48 p, 3 Fig.

Descriptors: *Model studies, *Aquifer systems, *California, *Groundwater, *Water levels, Alluvial aquifers, Pumping, Drawdown, Agriculture, Irrigation, Computer models, Projections, Water utilization, Water quality, Energy, Groundwater management, Water management(Applied), Evaluation, Central Valley(Calif).

Unconsolidated Quaternary alluvial deposits comprise a large complex aquifer system in the Central Valley of California. Millions of acre-feet of water is pumped from the system annually to support a large and expanding agribusiness industry. Since the 1950's, water levels have been steadily declining in many areas of the valley and concern has been expressed about the ability of the entire ground-water system to support agribusiness at current levels, not to mention its ability to function at projected expansion levels. At current levels of ground-water use, an estimated 1.5 to 2 million acre-feet is withdrawn from storage each year; that is, 1.5 to 2 million acre-feet of water is pumped annually in excess of annual replenishment. The U.S. Geological Survey has initiated a 4-year study to develop geologic, hydrologic, and hydraulic information and to establish a valleywide groundwater data base that will be used to build computer models of the ground-water flow system. Subsequently, these models may be used to evaluate the system response to various ground-water management alternatives. This report describes current problems, objectives of the study, and outlines the general work to be accomplished in the study area. A bibliography of about 600 references is included. (Kosco-USGS)
W80-05296

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR SOUTH FORK WILDCAT CREEK, CLINTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
C. G. Crawford, W. G. Wilber, and J. G. Peters.
Available from: OFSS, USGS, Box 25425, Fed Ctr, Denver CO 80225. Price codes: $9.25 in paper copy, $3.50 in microfiche. Geological Survey open-file report 79-1074, July 1979. 66 p, 23 Fig, 11 Tab, 59 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilation capacity, *Water quality, *Indiana, Streams, Forecasting, Streamflow, Low flows, Effluents, Water pollution, Water quality standards, Waste water disposal, Waste water treatment, Reaeration, Mathematical models, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, *Clinton County(Ind), *South Fork Wildcat Creek(Ind).

The Indiana State Board of Health is developing a State water-quality management plan that includes

establishing limits for wastewater effluents discharged into Indiana streams. A digital model calibrated to conditions in South Fork Wildcat Creek was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. Natural streamflow during the 7-day, 10-year low flow is zero, so no benefit from dilution is provided. The Indiana State Board of Health's projected ammonia-nitrogen concentration for the Frankfort wastewater-treatment facility will violate the instream total ammonia-nitrogen standard of 2.5 mg/l and 4.0 mg/l during summer and winter low flows, respectively. The model indicates that nitrification and algal respiration were significant factors affecting the dissolved-oxygen dynamics of South Fork Wildcat Creek during two water-quality surveys. Stream water quality during the two water-quality surveys was degraded by the discharge of wastewater receiving only primary treatment. Benthic deposits resulting from this wastewater discharge seem to exert a considerable oxygen demand. The discharge of partially treated wastewater should be eliminated when a new wastewater-treatment facility becomes operational in mid-1979. Therefore, benthic-oxygen demand due to benthic deposits should become negligible at that time. (Kosco-USGS)
W80-05299

CONTRIBUTION OF GROUNDWATER MODELING TO PLANNING,
Geological Survey, Reston, VA. Water Resources Div.
J. E. Moore.
Journal of Hydrology, Vol 43, p 121-128, 1979. 1 Tab, 15 Ref.

Descriptors: *Groundwater, *Computer models, *Analog models, *Planning, Digital computers, Groundwater availability, Forecasting, Water quality, Water supply, *Water resources development, Conjunctive use, Surface-groundwater relationships.

The consideration of ground water in water-resource planning frequently has been neglected because many planners believed that ground water could not be adequately evaluated in terms of availability, quality, cost of development, or effect of development on the surface-water supply. The development of predictive ground-water models now provides the water planner with tools to evaluate these problems. Highly sophisticated digital models can be used in planning the development of ground water and the conjunctive use of ground and surface water. The models are powerful tools for predicting the response of groundwater systems to stresses. They can also clarify the cause and progress of past stress. With this development it is now possible to integrate the utilization of ground water into water-resource planning with a high degree of confidence. (Kosco-USGS)
W80-05300

U.S. HEAVY METAL LOADINGS TO THE GREAT LAKES: ESTIMATES OF POINT AND NONPOINT CONTRIBUTIONS,
Great Lakes Basin Commission, Ann Arbor, MI
T. M. Heidtke, D. J. Scheflow, and W. C. Sonzogni.
Great Lakes Environmental Planning Study, Contribution No 12, January 1980. 35 p, 18 Tab, 19 Ref.

Descriptors: *Trace elements, *Sewage treatment, *Overland flow, *Great Lakes. Path of pollutants, *Heavy metals, *Municipal wastes, Copper, Zinc, Lead, Cadmium, Forecasting, Great Lakes Environmental Planning Study, Projected trace metal loadings, Municipal discharges, Point and nonpoint source inputs.

Estimates of current and future loadings of copper, zinc, lead and cadmium to the Great Lakes from municipal wastewater effluents and land drainage in the U.S. were generated using information provided by individual water quality management (208) plans, as well as other recent studies of point and nonpoint source pollution within the basin Projections indicate that by the year 1990 the U.S. municipal point source contribution will likely decrease by 20-30% from mid-1970 levels as a result of phosphorus control measures. In the absence of additional programs to control land drainage in the U.S., the annual lake input of these metals from rural runoff should exhibit a slight decrease (less than 5%) over the next 20 years, whereas loadings attributable to urban runoff should increase up to 20% over the same period. Land drainage in the U.S. portion of the Great Lakes basin appears to contribute a much higher input of metals than do municipal wastewater treatment plants. Hypothetical programs to control nonpoint source phosphorus loads within the basin were compared on the basis of their ability to reduce metals loads. Results indicate that low cost, voluntary measures to control rural runoff are not likely to significantly reduce metals loadings to the lakes, while remedial measures to control urban runoff, although costly, offer the potential for significant reductions in annual inputs of lead, zinc, copper and cadmium.
W80-05335

6B. Evaluation Process

THE ECONOMIC CONSEQUENCES OF IRRIGATING CORN ON FINE TEXTURED SOILS IN THE HUMID MIDWEST,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
R. L. Clouser, and W. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-185341, Price codes: A03 in paper copy, A01 in microfiche
Purdue University Water Resources Research Center Technical Report No 96, April 1980. 47 p, 15 Tab, 19 Ref, 1 Append. OWRT B-120-ILL(1).

Descriptors: *Irrigation, *Corn, *Economic feasibility, *Soil texture, Central United States, Irrigation practices, Supplemental irrigation, Farm ponds, Reservoirs, Wells, Humid areas, Irrigation systems, Soybeans, Farm management, Indiana, Illinois, Missouri.

Substantial research has been conducted on the economic profitability of irrigation on coarse textured soils in the humid Midwest. There has only been limited attention given to the irrigation of fine textured soils in the area. However, there is the potential for an economic response to irrigation on fine textured soils with a restricted zone for plant root development. A mathematical programming model of a micro farm unit was used in the study. The model maximizes net farm revenue by choosing production levels, subject to technical constraints between inputs and outputs, and an initial endowment of fixed resources. In addition to the basic model formulation, an investment model of alternative irrigation systems is incorporated. The model considers six alternative grain production activities including dryland corn, four alternative acreage levels of irrigated corn and soybeans. Irrigation application of six inches of water during July and August was an activity considered for irrigated cropland. The results indicated the average yield increase of corn of at least 40 bushels per acre per year or a discount rate of no more than 14 percent was necessary if an irrigation system was expected to provide a greater return than dryland corn production. (Wiersma-Ind)
W80-05102

APPLICATIONS AND EVALUATION OF DECISION ANALYSIS IN WATER RESOURCES PLANNING,
Decision Science Consortium, Inc., Falls Church, VA.
For primary bibliographic entry see Field 6A.
W80-05104

AN APPRAISAL OF CULTURAL AND PALEONTOLOGICAL RESOURCES WITHIN SECTIONS 1 AND 2 OF THE PROPOSED MIRDAN CANAL PROJECT, GARFIELD AND VALLEY COUNTIES, NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Anthropology.
N. S. King, and R. E. Pepperl.
Technical Report No 80-03, March 1980. Vol 1, 65 p, 1 Fig, 4 Tab, 74 Ref, 2 Append.

Descriptors: *Nebraska, *Archaeology, *Dating, *Surveys, Evaluation, History, Geologic history, Land use, Irrigation programs, Canal construction, Engineering, Inspection, Value.

Thirty-one locations of contemporary and early twentieth century material were identified in a cultural resources evaluation within sections 1 and 2 of the proposed Mirdan Canal project. The Mirdan Canal, designed to carry water from the Calmus Reservoir to the Davis Creek Reservoir, is part of a multi-purpose irrigation development within the North Loup Division, Nebraska. Steps involved in the survey included: (1) a records search, (2) a literature search, (3) National Register consultation, (4) paleontological records search and consultation, (5) county court records search, (6) field investigations, and (7) laboratory preparation and analysis of collected materials. Two separate field investigations were conducted, a reconnaissance level investigation of a one-acre seepage test and an intensive (100%) pedestrian survey of the entire area. In both surveys all accessible surface areas were systematically inspected and either zig-zag or straight line traverses were used depending on terrain and visibility. Some acreage was inaccessable but nearly 95% was completely surveyed. No paleontological or prehistoric Native American sites were located. In addition to the 31 contemporary and early twentieth century locations, 4 abandoned habitation sites and 23 isolated locations of discarded debris and dump areas were identified. Based on these results further investigations prior to construction are not recommended, however, construction crews should be made aware of the potential for encountering buried cultural resources. (Seigler-IPA)
W80-05109

FINAL REPORT ON SAMPLING AND EVALUATION OF ARCHAEOLOGICAL AND HISTORICAL SITES IN OR NEAR BUREAU OF RECLAMATION'S AUTHORIZED SALMON FALLS DIVISION, TWIN FALLS AND CASSIA COUNTRIES, IDAHO,
Idaho Museum of Natural History, Pocatello.
B. R. Butler, and P. R. Waite.
Archaeological Reports No 17, November 1978. 92 p, 42 Fig, 28 Tab, 15 Ref. 14-06-100-9135.

Descriptors: *Evaluation, *Archaeology, *Dating, *History, *Idaho, Human population, Land use, Surveys, Equipment, *Irrigation canals, Irrigation engineering, Irrigation programs, Diversion structures, Baseline studies.

Three seasons of archaeological survey and evaluation at the site of the proposed Salmon Falls Division irrigation project in Idaho identified eight aboriginal and four historical sites that may be damaged by the project. The project will involve the construction of a canal system running southwestward from the Milner Dam on the Snake River. The project will provide water to approximately 15,000 acres that are now dry. Only limited knowledge of the native people, the Shoshoni, is available. The eight aboriginal sites were all located within a 4 x 13 mile area across the northern end of the South Hills. These sites were evaluated by excavating a 1 m x 2 m pit in every 400 sq m sampling stratum mapped for each site. Data provided for each site include number of pits, number of cataloged artifacts, and number of waste flakes. At the sites lithic chipping debris strongly represents tool manufacturing and repair. From projectile point analysis two sites on Rock Creek were dated from the Early Archaic (5,800 B.C.-2,500 B.C.), while the other sites generally dated from the Middle Archaic (2,500 B.C.-A.D. 1,200-1,300). The four historical sites were evaluated by surface study only. Two of the historical sites are believed to be part of the many lateral tracks from the Oregon Trail. A third historical site was composed of broken glass along the bank of the irrigation canal and the fourth was the foundation of a turn of the century barn. While none of the sites are likely to yield much new information, disturbance of the sites should be avoided when possible. (Seigler-IPA)

W80-05113

WATER-MANAGEMENT PLANNING FOR ILLINOIS COMMUNITIES,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
A. Weeks.
Report No UILU-WRC-79-0009, Special Report 9, July 1979. 97 p, 1 Fig, 6 Tab, 31 Ref. OSS 77-21209.

Descriptors: *Illinois, *Administration, *Water management(Applied), *Water utilization, Project planning, Soil erosion, Sedimentation, Water supply, Water rates, Water wells, Water resources development, Water policy, Land use, Economic feasibility.

Ten documents on water management and planning prepared as part of a series of community education programs in Illinois are presented as background material for community citizens and officials to provide a common denominator of knowledge. The documents presented are: (1) Introduction to Water-Management Planning, (2) Water Conservation, (3) Water Availability: Present Adequacy and Future Alternatives, (4) Water Quality and the Water System, (5) Management, Planning, and Maintenance of Municipally Owned Water Systems, (6) Economic Concerns and Financing of Water Systems, (7) Private Home Water Systems, (8) Areawide Options, (9) Soil Erosion, and (10) The Role of Water and Reservoirs in Economic Growth. Technical terms are avoided when possible and some costs are provided as a basis for comparisons. Five main aspects are involved in water-management planning: the quantity of water naturally available; the quality of available water; the adequacy, reliability, and maintenance of the water system; waste water treatment and reuse; and community needs and resources. Also, land use planning and water management must go together. Included at the end of each document is a list of questions to help a community find specifics about its own situation along with possible sources for answers. (Seigler-IPA)
W80-05115

OPTIMUM ALTERNATIVES FOR CONTROLLING COMBINED SEWAGE OVERFLOWS--A CASE STUDY,
Barr Engineering Co., Minneapolis, MN.
I. Yomtovian.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 129-146, 1978. 5 Fig, 2 Tab, 6 Ref. EPA C270831-2.

Descriptors: *Decision making, *Combined sewers, *Urban runoff, *Alternate planning, Overflow, Planning, Conveyance structures, Urban hydrology, Separated sewers, Bypasses, Water quality, Water pollution sources, Economics, Costs, Methodology, Analytical techniques, Dissolved oxygen, *Red Wing(MN), Case study, Sanitary sewage overflow.

The major concern of this study is the control and treatment of sanitary sewage overflows from the combined sewer systems located in Red Wing, Minnesota. Frequent high quantity untreated sanitary flows entering the Mississippi River (MR) at Red Wing are degrading the water quality of the river. The high rate of sanitary sewage overflow into the river is primarily due to the existence of the inadequate and poorly located sanitary sewer interceptors. The untreated sanitary sewage flow by-passes the existing treatment plant under the following three distinct conditions: (1) when the MR water elevation exceeds the invert elevation of the combined sewer systems; (2) when dry weather sanitary flows exceed the maximum intake capacity of the regulators; and (3) when the combined sanitary and storm runoff exceeds the maximum intake capacity of the regulators and the available storage capacity of the combined sewers. The optimum waste control measure is the combination of the most cost-effective alternatives which provide the most acceptable (desirable) waste control level. To facilitate the process of decision making in the selection of optimum alternatives, the following schemes were suggested: select the most cost-effective combination of alternatives based on the available budget, an acceptable percentage of waste control, and/or based on the waste control costs ($/MGY) spent in other cities comparable to Red Wing. (See also W80-05159) (Humphreys-ISWS)
W80-05170

EFFECTS OF RURAL WATER SYSTEMS ON LOCAL GOVERNMENT REVENUES AND EXPENDITURES IN SELECTED COUNTIES OF SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Economics.
A. A. Lundeen, and L. L. Janssen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-188055, Price codes: A10 in paper copy, A01 in microfiche. South Dakota Water Resources Institute, South Dakota State University Completion Report 1979. 219 p, 2 Fig, 48 Tab, 25 Ref, 10 Append. OWRT B-056-SDAK(1), 14-34-0001-8118.

Descriptors: *Rural areas, *South Dakota, *Water distribution(Applied), *Government finance, Taxes, Economic analysis, Regression analysis, Surveys, Statistical methods, Population, Income analysis, Education, Mathematical models, Water systems.

Surveys and statistical analyses were used to evaluate the impact of the Brookings-Deuel Rural Water System on the revenues and expenditures of local governments in the area. Two mail surveys were used to gather demographic data and housing characteristics for the population and its subgroups in the area served by the water system. Chi-square, analysis of variance, and multiple regression tests were used to determine if significant differences existed. Personal interviews were conducted to gather information on housing, farming operations, consumer purchases, satisfaction with the water system, and perceptions of changes by the owners in their property value due to the water system. County officials, school district officials, realtors, and appraisers were also interviewed. Using the data collected a previously developed model was modified to simulate the effects of the rural water system on the public sector. The model can be used to estimate a range of impacts. Results show that farm or nonfarm employment and income orientation are related to system membership, rural user families are younger than nonuser families, users have higher income levels than nonusers, education levels of adults is not related to system use, and users have one or more children than nonusers. Approximately 40% of those surveyed felt that the water system increased the value of their land. Net positive gains were found for all but one unit of government. Gains in total property tax revenues from the increase in property value are not occurring and may not occur unless new assessments of property for tax purposes reflect this increase in value. (Seigler-IPA)
W80-05242

A DYNAMIC REGIONAL IMPACT ANALYSIS OF FEDERAL EXPENDITURES OF A WATER AND RELATED LAND RESOURCE PROJECT -- THE BOISE PROJECT OF IDAHO, PART II: SECONDARY ECONOMIC IMPACTS OF THE BOISE PROJECT OF IDAHO, 1947-1970,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. B. Long, and C. J. Potratz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-191430, Price codes: A07 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho. Research Technical Completion Report, March 1979. Volume II of V. 118 p, 21 Fig, 6 Tab, 19 Ref, 7 Append. OWRT C-6276 (No 5226)(3).

Descriptors: *Idaho, *Economic impact, *Input-output analysis, *Irrigation systems, Economics, Mathematical studies, Food processing industry, Industries, Cost-benefit ratio, Cost repayment, Econometrics, Benefits, Annual costs, Financial analysis, Monetary benefits, Boise Project.

Secondary or induced economic impacts resulting from the Boise Project, an irrigation and power project in southwestern Idaho, are analyzed. The Project was built by the Bureau of Reclamation between 1910 and 1956 and is now managed for irrigation, power, recreation, and flood control. The Project has produced a thriving irrigated agricultural production area of approximately 340,000 acres as of 1970. This agricultural production in turn has resulted in the growth of supplying (input) industries and agricultural (output) processing industries. An aggregate economic input-output model is used to simulate the impact of the Boise Project on the Idaho economy. Results indicate that direct income impacts increased from $17.9 million in 1947 to $28.1 million in 1970. For the same time period indirect or secondary impacts increased from $45.9 million to $99.1 million. Since 1947 the total impact of the project on regional income has dropped from 41.4% to 22.1% which shows that the region is expanding more rapidly than the Project. The Project has had a major influence on the development and growth of the area's food processing industry. In 1970 the food processing industry's economic impact ($143.7 million) was greater than the Project's economic impact ($127.2 million). Also as of 1970, annual project impact both direct ($28.1 million) and indirect ($99.1 million) more than repay the annual Project costs of $5.5 million. (Seigler-IPA)
W80-05243

SECOND HOMES IN NORTH CAROLINA: AN ANALYSIS OF WATER RESOURCE AND OTHER CONSEQUENCES OF RECREATIONAL LAND DEVELOPMENT,
North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
R. J. Burby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190648, Price codes: A12 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina, Raleigh. Report No UNC-WRRI-79-150, December 1979. 278 p, 43 Tab, 137 Ref, 4 Append. OWRT A-092-NC(3).

Descriptors: *Land use, *North Carolina, *Recreation facilities, *Land development, Environmental effects, Recreational demand, Cost-Benefit analysis, Economics, Erosion, Septic tanks, Mountains, Coasts, Land management, Land resources, Recreation.

The environmental impact of recreational land development was studied in 18 mountain and 20 coastal counties in North Carolina. North Carolina has experienced a boom in second homes and recreational land development; however, 40% of this development is concentrated in only 5 of the 38 counties studied. Three sources of data were used for the study: (1) secondary data from the Office of Interstate Land Sales Registration; (2) original data from mail questionnaires returned by 71 development firms in the state; and (3) original data from two waves of personal interviews with a sample of 227 local officials. Environmental, social, fiscal, and economic consequences of development were identified. Local public officials of the developed areas overwhelmingly believe that development has been beneficial to their counties due to positive economic consequences. A conceptual model was developed to explain how the objective characteristics of the environmental impacts are associated with officials' perceptions of those atributes. Problems associated with development include septic tank failures, pollution, erosion, roadside litter, inadequate access, traffic congestion, and flooding. Adverse economic effects include steeply escalating land prices and increased demand for public services. Both coast and mountain officials feel that existing local and state institutions could do more to promote improved land development practices. Increased citizen awareness would also be a positive step. (Seigler-IPA)
W80-05248

LAKE SUPERIOR IN THE 21ST CENTURY,

Canada Centre for Inland Waters, Burlington (Ontario).
H. Shear.
Journal of Great Lakes Research, Vol 4, No 3-4, p 550-553, December 1978. 3 Tab, 7 Ref.

Descriptors: *Lake Superior, *Projections, *Population, *Economics, Land use, Phosphorus, Waste disposal, Water pollution sources, Fisheries, Agriculture, Industries, Mining, Forestry, Twenty-first century.

Projections of population, industrial growth, phosphorus inputs, changes in land use patterns and waste disposal are given. Phosphorus loadings to Lake Superior from point sources are projected to increase only slightly by the year 2020, assuming all large sewage treatment plants meet a 1 mg/l effluent limitation. Increases in industrial and mining activities could have significant negative impacts on the lake, but these impacts have not been quantified. The Great Lakes community has adopted a philosophy of no further degradation of Lake Superior. In order to achieve this, more efficient and innovative methods will have to be employed to ensure that pollutants do not enter the lake from industrial discharges, municipal sewage treatment plants, urban runoff, and runoff from waste disposal sites. (Humphreys-ISWS)
W80-05265

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FRANCE: WHERE THE METER IS 'UNIVERSAL',
L. Freeman.
Water, No 31, p 43-44, March 1980. 4 Fig.

Descriptors: *France, *Water supply, *Water costs, *Water rates, Water distribution(Applied), Potable water, Water purification, Ozone, Potable water, Environmental sanitation, Sewage disposal, Taxes, Costs, Water meters.

The French water industry continues to move forward with services, billing, and the supplying of potable water. The industry has used meters since its establishment in the early 19th century. The industry also provides all the sanitation services. Not only does the consumer pay for water and sanitation services, he also pays several taxes such as a value added tax (VAT) of 7%, a tax to subsidize services to rural communities, and local taxes. Approximately 40% of a customers bill is for water supplied while 60% goes for taxes. These taxes have approximately doubled the customer's cost in the last few decades. The average annual bill for a family of four is about 800 Francs. France has five major water companies that supply a total of 1,500 million cubic meters a year. The oldest company, Compagnie Generale des Eaux, provides approximately 5 million cubic meters daily. All the French water companies use ozone rather than chlorine for purification. A large ozonization plant at Choisy-le-Roi near Paris produces 800,000 cubic meters daily. Despite the current use of a metering system, the industry does have problems with reading them. Future developments include the use of remote reading using computers and cable television linkups. (Seigler-IPA)
W80-05118

6D. Water Demand

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1977 -- NOVEMBER 30, 1978,
Geological Survey, Reston, VA. Water Resources Div.
F. T. Schaefer, and R. E. Fish.
Geological Survey Delaware River Master report, 1979. 94 p, 6 Fig, 1 Plate, 20 Tab.

Descriptors: *Delaware River, *Watershed management, *Available water, *Water delivery, *Water quality, Reservoir storage, Reservoir releases, Estuaries, Saline water intrusion, Monitoring, *Delaware River Master, Annual report.

This annual report of the River Master of the Delaware River is for the year December 1, 1977, to November 30, 1978. In terms of water supply, the year was above normal. The discharge of the Delaware River at Montague, New Jersey, adjusted for diversions and changes in reservoir storage, was 14 percent above median. Total combined storage in Pepacton, Cannonsville, and Neversink Reservoirs was 98.0 percent of capacity on December 1, 1977, as compared with 87.9 percent a year earlier. This was the highest total storage at the beginning of any report year since the construction of the reservoirs. Diversions for water supply for New York City and releases to maintain the flow of the Delaware River at Montague were made under the supervision of the River Master, as provided in the terms of the Amended Decree of the Supreme Court, June 7, 1954. Diversions through the Delaware & Raritan Canal in New Jersey did not exceed the limits imposed in Section V of the Decree. Data from the Water-quality monitoring program carried out by the U.S. Geological Survey in the Delaware River Estuary are included. (Kosco-USGS)
W80-05292

AVAILABILITY OF SUPPLEMENTAL WATER SUPPLIES AT SALMONID FISH-PROPAGATION STATIONS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
C. A. Harr, and R. P. Novitzki.
Available from: OFSS, Box 25425, Fed Ctr, Denver CO 80225. Price codes: $2.00 in paper copy, $4.00 in microfiche. Geological Survey open-file report 79-1170, October 1979. 13 p, 5 Fig, 4 Tab, 3 Ref.

Descriptors: *Groundwater availability, *Surface water availability, *Water supply, *Fish hatcheries, Streamflow, Flow characteristics, Diversion, Impoundments, Aquifers, Wells, Water yield, Pumping, Estimating, Digital computers, Drawdown, Water quality, Wisconsin, *Salmonid fish-propagation stations, Supplemental water supplies.

Supplemental water supplies are available at all the 12 fish-propagation stations. At seven of the stations water may be obtained by diverting or impounding streams. Ground water is available from glacial sand-and-gravel aquifers at all the stations and from sandstone aquifers at 7 of the 12 stations. Probable well yields range from 100 to 1,000 gallons per minute from the sand and gravel and from 50 to 1,000 gallons per minute from the sandstone. The response of pumping 1,600 gallons per minute from a ground-water source at Crystal Springs, Langlade, Nevin, and Osceola was estimated by a digital model. Estimated drawdown after 10 years of pumping ranged from 10 to 28 feet (6 to 35 percent of the saturated thickness of the aquifers). (Kosco-USGS)
W80-05304

MANAGING A LIMITED RESOURCE: THE POLITICAL CONSTRAINTS ON WATER POLICY IN THE FOUR-CORNERS STATES,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 6E.
W80-05370

COMMENTS ON 'FEDERAL RESERVED WATER RIGHTS',
Debevoise and Liberman, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05375

6E. Water Law and Institutions

AN EVALUATION OF ILLINOIS LAWS AND REGULATIONS RELATED TO THE QUALITY OF GROUND WATER.
Illinois Univ. at Urbana-Champaign.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-183528, Price codes: A06 in paper copy, A01 in microfiche. Report, June 1979. 110 p, 2 Tab.

Descriptors: *Illinois, *Reviews, *Groundwater, *Legislation, *Water law, Water pollution control, Water quality, Legal review, Regulation, Administration, Water utilization, Water policy, Water pollution sources, Water quality standards, Institutions, Water permits, Permits, Waste water disposal, Waste disposal wells, Waste disposal.

This study contains an analysis of existing Illinois statutes, administrative regulations, and policies and practices affecting the quality of groundwater, together with recommendations for changes needed to establish a comprehensive groundwater protection program for the state. Some principal tasks of the research were to: (1) identify regulatory deficiencies, gaps, and overlaps, (2) examine federal laws, regulations, and court decisions to determine requirements applicable to state control of groundwater pollution, and (3) recommend modifications of Illinois statutes, regulations, policies, and implementation practices to achieve a comprehensive and effective program. The following eight proposals were made: (1) adopt a policy to protect groundwater quality, (2) designate an agency with primary responsibility for groundwater quality, (3) develop a groundwater data base, (4) develop a groundwater quality monitoring program, (5) establish groundwater quality standards, (6) regulate water use to control groundwater quality, (7) control surface water quality, and (8) develop specific standards, permits, and management practices for specific activities causing groundwater pollution. Recommendations were also made for control of specific pollution sources, with priority rankings, for the form of the proposed control, e.g., legislation, regulation, or administrative practice, and for the identity of agencies whose authority would be exercised, increased, or decreased if the proposal were implemented. (Stout-Illinois)
W80-05154

ASSESSING LAND USE CHANGES WITH AN URBAN RUNOFF MODEL,
North Virginia Planning District Commission, Falls Church.
For primary bibliographic entry see Field 2A.
W80-05239

COMPARISON OF STORMWATER DETENTION POLICIES,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-05241

EPA SETS RULES ON HAZARDOUS WASTES,
For primary bibliographic entry see Field 5G.
W80-05322

TURN THIS WATER INTO GOLD THE STORY OF THE NEWLANDS PROJECT,
Nevada Historical Society, Reno.
J. M. Townley.
1977, 160 p, Nevada Historical Society, Reno. OWRT A-074-NEV(4), 14-34-0001-7060.

Descriptors: *Irrigation districts, *History, *Federal reclamation law, *Nevada, Water resources development, Land resources, Irrigation systems, U.S. Bureau of Reclamation, *Truckee-Carson Irrigation District(NV), Churchill County(NV), Federal Reclamation Act of 1902.

This book is primarily a biography of the first federal reclamation district in the U.S. The Truckee-Carson Irrigation District is a cooperating organization composed of members, geographical areas, numerous dams, canals, reservoirs and electrical plants, farms, dairies, cattle feeding operations, residential communities and recreation-wildlife sanctuaries. The year 1976 marked the 50th anniversary of self-rule for this district. In 1926 the U.S. Bureau of Reclamation transferred control to the newly formed TCID (Truckee-Carson Irrigation District). The book, replete with photographs, traces the history of the area from the 1800's to 1976 and documents the many problems faced by the irrigation district since the National Reclamation Act of 1902. (Smith-Nevada)

W80-05328

RECLAMATION AND THE RED MAN: RELATIONSHIPS ON THE TRUCKEE-CARSON PROJECT, NEVADA,
Nevada Historical Society, Reno.
J. M. Townley.
The Indian Historian, Vol 11, No 1, p 21-28, 1978.
OWRT A-074-NEV(3), 14-34-0001-7060.

Descriptors: *Paiute Indians, *Indian reservations, *Reclamation, *Irrigation, *Water rights, Legal aspects, Nevada, Truckee-Carson Irrigation District(NV), U.S. Reclamation Service.

This article traces the developing relationships among the U.S. Reclamation Service (USRS), formed in 1902 as a progressive measure, the white entryman, and the Indian during the period 1903 to 1926, at which time operational control of the federally funded reclamation project passed to the locally-directed TCID (Truckee-Carson Irrigation District), Nevada. The Indians of Lahontan Valley, as well as those around Pyramid Lake, were very much affected by the Truckee-Carson Project, and a series of court cases followed. Between 1903 and 1926 decisions imposed by USRS and Congress took about 30,000 acres from Paiute allottees in exchange for ten-acre plots within a reservation composed of only seven sections. The history of attempts to settle the Indians on the reservations and the conditions therein are described. (Smith-Nevada)
W80-05329

PHOSPHORUS CONTROL STRATEGIES AT MUNICIPAL WASTEWATER TREATMENT PLANTS IN THE U.S. GREAT LAKES BASIN,
Great Lakes Basin Commission, Ann Arbor, MI.
For primary bibliographic entry see Field 5D.
W80-05336

THE URBAN COAST FROM A NATIONAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.
A. B. Cowey.
Coastal Zone Management Journal, Vol 6, No 2/3, p 135-165, 1979. 2 Maps.

Descriptors: *Coasts, *Shore protection, *Public access, *Urbanization, Federal government, Environmental effects, Administrative agencies, Resources development, Legislation, Ecology, Management.

Nearly 40% of the United States population is concentrated in coastal urban centers whose populations exceed 500,000. The pressures for new housing, tourist, and recreational facilities, as well as environmental concerns, have contributed to intra-urban conflict over the direction and appropriate mix of waterfront uses. To date, no one federal agency or program has been specifically charged with overseeing the urban coastal resource as an entity, nor is it likely that one will. However, national concern for various aspects of the urban coastal issues has been expressed. In 1972, the Coastal Zone Management Act declared a national interest in the effective management, beneficial use, protection and development of the coastal zone. A national involvement can also be traced through a number of federal activities. These include the Urban Recreation Study, the Urban Waterfront Study, the Maritime Preservation Program, shorefront access and planning, and the implementation of State Coastal Zone programs. (Wilson-Florida)
W80-05363

THE LOST WATERFRONT OF NEW YORK,
New York Univ., NY. Graduate School of Public Administration.
M. L. Moss.
Coastal Zone Management Journal, Vol 6, No 2/3, p 167-185, 1979. 2 Tab.

Descriptors: *New York, *Shore protection, *Local governments, Urbanization, Water law, Land use, Programs, Administrative agencies, Public access, Planning, Management.

The New York City (NYC) waterfront differs dramatically from most urban coastal areas in the United States. In size its shoreline is far more extensive than any other city's. Municipal ownership of much of the waterfront gives the city direct control over the use of substantial portions of abutting land. No integrated policy exists for managing the NYC waterfront. Municipal government has done little to improve the shoreline. Citizens' groups and other organizations have made the greatest effort to improve the use of the city's coastal resources. NYC needs a well-defined policy for formulating and implementing programs in the coastal zone. An initial step for the city is to establish an accurate, reliable and up-to-date information system for the waterfront property it owns. Second, the city needs to develop a program for increasing public access to the waterfront. Third, more attention and assistance must be given to local groups. Finally, the city must press for an urban perspective in coastal management with external agencies. (Wilson-Florida)
W80-05364

ENERGY FACILITY SITING IN THE URBAN COASTAL ZONE: COMPATIBLE OR NOT,
Princeton Univ., NJ.
D. L. Morell.
Coastal Zone Management Journal, Vol 6, No 2-3, p 215-232, 1979. 2 Fig.

Descriptors: *Energy, *Facilities, *Coasts, *Shore protection, Water law, Environmental effects, Sites, Power operation and maintenance, Cooling water, Public access, Oil industry, Water pollution.

In recent years a rural/urban coastal dichotomy has emerged. This has been especially prominent in the siting of energy facilities since these operations are often water dependent. Power plants need huge amounts of cooling water. Offshore oil and gas extraction requires onshore support facilities. Recently, this issue has gaines special prominence on the East Coast with the commencement of offshore oil and gas exploration. A case study was conducted in Hudson County, New Jersey, in New York harbor, where five oil-related facility proposals were rejected from 1972 to 1976, primarily due to citizen opposition. Citizen activists now see the urban waterfront as a special place to which they want access. Amenity uses are preferred over a continuation of past, almost exclusive, industrial development. Citizen opposition is primarily concerned with pollution and safety. Innovative siting which utilizes inland, rather than coastal, locations is suggested as one way to lessen urban/rural siting controversy. (Wilson-Florida)
W80-05365

COASTAL ZONE MANAGEMENT: THE FIRST FIVE YEARS AND BEYOND,
National Oceanic and Atmospheric Administration, Washington, DC.
R. W. Knecht.
Coastal Zone Management Journal, Vol 6, No 4, p 259-272, 1979.

Descriptors: *Coasts, *Shore protection, *Federal government, State governments, Wetlands, Resources development, Public access, Inter-agency cooperation, Administrative agencies, Legislation, Environmental control, Management.

More than five years have passed since the Office of Coastal Zone Management issued the first coastal zone management (CZM) program development grants. Since then, all 35 coastal states and territories have participated in the program. By spring 1980, more than 75% of the country's shoreline will be covered by federally approved management plans. Any examination of the national CZM program involves consideration of the record at the state and local levels. Substantive results are expected in four major areas. First, and foremost, is protection of such natural resources as wetlands, beaches, dunes, and barrier islands. Second is the concern for more effective coastal development management. A Third area is increasing recreational access to the coast. Fourth is an emphasis on increasing intergovernmental cooperation and coordination. Today the emphasis of the CZM program is shifting from planning to implementation. A proposed amendment to section 303(b) of the Coastal Zone Management Act will clearly incorporate full consideration of national needs during the implementation of CZM programs. (Wilson-Florida)
W80-05366

A PETROLEUM INDUSTRY PERSPECTIVE ON FEDERAL COASTAL ZONE MANAGEMENT,
American Petroleum Inst., Washington, DC.
S. P. Chamberlain.
Coastal Zone Management Journal, Vol 6, No 4, p 281-294, 1979.

Descriptors: *Oil industry, *Federal government, *Land use, *Shore protection, Coasts, Programs, Administrative agencies, Legislation, State governments, Regulations, Environmental control, Energy.

Two of the most ambitious provisions of the Coastal Zone Management Act (CZMA) require consideration of national interests in facility siting and federal consistency with approved state programs. The petroleum industry is most concerned with the federal consistency requirement which allows state coastal management policies to assume the force of federal law by virtue of the National Oceanic and Atmospheric Administration's (NOAA) approval of a state coastal zone management program. Moreover, the comples federal consistency procedures under CZMA are counter-productive to the expressed purpose of the Outer Continental Shelf Lands Act. The petroleum industry's secondary concern is NOAA's interpretive changes of the Act and its regulations which allow state programs approval based on inadequate state statutory and regulatory frameworks. This has occured where states give inadequate consideration to the national interest, unwilling to adopt stronger oversight control over local land-use decisions as required by the CZMA. Strong Congressional reaffirmation of CZMA's intent is needed to redirect NOAA's implementation of the Act. (Wilson-Florida)
W80-05367

UNRESOLVED ISSUES OF COASTAL ZONE MANAGEMENT,
Rose, Schmidt, Dixon, Hasley, Whyte and Hardesty, Washington, DC.
J. R. Spradley, Jr.
Coastal Zone Management Journal, Vol 6, No 4, p 303-310, 1979.

Descriptors: *Energy, *Shore protection, *Facilities, *Resources development, Coasts, Administrative agencies, Oil industry, Sites, Programs, Planning, Land use, Legislation.

The Coastal Zone Management Act (Act) has been subjected to conflicting claims of inadequacy, by both governmental agencies and private users of the coastal zone, such as the electric utility and petroleum industries. Electric energy facilities are of national and state interest but of regional and local benefit. Once the need for a facility has been determined, industry is concerned with management of environmental impacts from these facilities. Section 307 of the Act covers federal agency activities and development projects, requiring federal agency actions be consistent. Coastal interests have differing concerns regarding federal consistency. The most immediate impact of federal consistency on the electric utility industry is its application to existing facilities. Section 306(c) (8) of the Act requires that each state program give adequate consideration to national interests in planning and siting energy facilities. However, regulations of the National Oceanic and Atmospheric Administration discourages consideration of the national interest in energy facilities. Congressional clarification or amendment is necessary to limit application of federal consistency to new facilities and to properly balance coastal resources with the need for energy facilities. (Wilson-Florida)
W80-05368

INDIAN RESERVED WATER RIGHTS: THE WINTERS OF OUR DISCONTENT.
Yale Law Journal, Vol 88, No 8, p 1689-1712, July 1979.

Descriptors: *Water rights, *Indian reservations, *Reservation doctrine, Prior appropriation, Judicial decisions, Water users, Water shortage, Economic impact, Regional development, Resource allocation, Resources development.

Enormous Indian water claims will strikingly affect the economic futures of both the Indians and the western states. Unfortunately, legal uncertainty about Indian water rights impedes future western growth and threatens Indian aspirations for economic improvement. The Supreme Court in 1908 recognized an implied water right, independent of state law, associated with Indian reservations. Most Indian reserved rights have never been officially quantified. Indians are now demanding larger amounts of water than previously used, extending claims beyond available supplies and threatening the rights of current non-Indian water users. The legal uncertainty of Indian water rights impairs public water planning, distorts water investment decisions and handicaps negotiations important to Indian economic development. Possible avenues for defining the scope of Indian reserved rights - administrative, legislative, and judicial decision-making- are evaluated. As a first step in resolving the Indian water dilemma, the federal courts must define the scope of Indian reserved water rights. (Daniels-Florida)
W80-05369

MANAGING A LIMITED RESOURCE: THE POLITICAL CONSTRAINTS ON WATER POLICY IN THE FOUR-CORNERS STATES,
Arizona Univ., Tucson.
H. Ingram, N. Laney, and J. R. McCain.
Utah Law Review, Vol 1979, No 4, p 719-745, 1979. 17 Tab.

Descriptors: *Water allocation(Policy), *Political aspects, *Water policy, *Federal-state water rights conflicts, Surveys, Energy, Federal government, State governments, Reclamation, Water rights, Public rights, Federal project policy.

Westerners feel abundant water is the key to economic prosperity, and so important to the quality of life that it must be made available to everyone. Such views underlie the distributive water politics that have resulted in Congress' authorizing and funding of scores of large-scale reclamation projects through a process of log-rolling and mutual accomodation. If past practices of federal dominance in planning and financing of projects is to change, the role of state governments will be crucial. Data reveals that both voters and state legislators tend to favor future water allocation on the same basis as the present. Some differences between senators' and voters' opinions about water emerge. Legislators are more willing to change water allocations among users. However there is little constituency incentive for legislators to take positive action in water policy. If the direction of water politics is left to the residents of western states and their elected state representatives, there may be little change from past policy. (Wilson-Florida)
W80-05370

COASTAL ENERGY IMPACT PROGRAM BOUNDARIES ON THE ATLANTIC COAST: A CASE STUDY OF THE LAW APPLICABLE TO LATERAL SEAWARD BOUNDARIES,
D. R. Christie.
Virginia Journal of International Law, Vol 19, No 4, p 841-882, Summer 1979. 2 Fig.

Descriptors: *Boundaries(Property), *State jurisdiction, *Oceans, *Boundary disputes, State government, Federal government, International law, Law of the sea, Legal aspects, Legislation, Judicial decisions, Monetary benefits.

Interstate seaward boundaries are important in questions of conflicts of law and in allocation of funds under the Coastal Energy Impact Program (CEIP). If no state seaward boundary exists, a state's adjacent continental shelf acreage is determined according to applicable principles of law. These include specifically the Convention on the Territorial Sea and the Contiguous Zone and, generally, international law, United States (U.S.) statutory and case law, and conventions. International, national and the individual states legal positions concerning the extension of state boundaries are discussed with possible solutions to the boundary dilemma included. Inconsistencies might arise between boundary delimitations for CEIP allocations and for state law under the Outer Continental Shelf Lands Act.Boundary drawing as a method for allocating CEIP funds is analyzed. This method is inadequate to meet the stated purposes of the CEIP and has created needless administrative confusion. (Daniels-Florida)
W80-05371

GEOTHERMAL DEVELOPMENT AND WESTERN WATER LAW,
O'Melveny and Myers, Los Angeles, CA.
O. Olpin, A. D. Tarlock, and C. F. Austin.
Utah Law Review, Vol 1979, No 4, p 773-887, 1979. 7 Fig.

Descriptors: *Geothermal studies, *Energy, *Resources development, *State governments, Groundwater resources, Mining, Subsurface investigations, Federal Government, Legal aspects, Energy conversion, Geology.

Geothermal resources currently occupy a small place in United States energy policy. Various estimates of the geothermal potential state that geothermal resources could provide as much as 100,000 megawatts of electrical power for thirty years. Geothermal resources are located primarily in the far west. To exploit a natural resource, some property right in the resource must be established. The laws of hard rock minerals, oil and gas, and water do not provide suitable analogies, because the geothermal resource is direct heat energy ready to be put to use. Several surface owners may be able to tap a common supply, but the supply may be interconnected with other natural resources. It will be undesirable to regulate geothermal resources merely as groundwater resources. The federal government and thirteen western states have some regulation of geothermal development. Applicable state property law for geothermal resources will apply to development on state and privately held land. Conflicts between federal geothermal leases and conventional water users raise more difficult issues. (Wilson-Florida)
W80-05372

CARACAS, 1974: INTERNATIONAL REGULATION OF OCEAN ECOLOGY.
Golden Gate Law Review, Vol 5, No 2, p 325-365, Spring 1975.

Descriptors: *Water Pollution Control, *Law of the sea, *Oceans, *Oil pollution, Water pollution sources, Sea water, United Nations, International waters, Waste disposal, International law, Treaties.

The purpose of the 1974 Third United Nations Law of the Sea Conference was to achieve international implementation and agreement for dealing with marine pollution. To define the scope of marine pollution problems, previous attempts at effective control are analyzed. During the 1974 Conference, various draft texts were prepared by subcommittees to form the basis for international agreement on marine environment preservation. No consensus was reached, and the likelihood of a meaningful agreement on pollution control is remote. Nations wishing to act affirmatively must rely on existing conventions and general principles of international law. Increased unilateral action may result with marine pollution control falling victim to expanded claims of ocean jurisdiction by individual nations. This and other possible results of a sluggish international authority are discussed. Alternatives to a world oceans treaty are suggested. (Schwerer-Florida)
W80-05373

FEDERAL CONTROL OF WATER POLLUTION - AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE,
Levine and Krom, Beverly Hills.
S. B. Levine.
Beverly Hills Bar Association Journal, Vol 9, No 3, p 34-39, May-June 1975.

Descriptors: *Federal Water Pollution Control Act, *Economic impact, *Water pollution control, Economic efficiency, Industrial wastes, Legislation, Water pollution, Water pollution sources, Water quality control, Effluents, Regulation.

The decade of the 1970's may be considered a pivatal period for improving the environment through the 1972 Federal Water Pollution Control Act Amendments (Act). Major provisions of the new amendments are: (1) a national goal to eliminate pollutant discharge by 1985; (2) construction of publicly-owned waste reatment facilities; (3) limitations on point source effluents; and (4) mandatory permits for pollution sources. As regulations are issued and legal action instituted pursuant to the amendments, there is increased concern about the need for reliable information on the economic costs of implementing the Act. For example, what are the costs in terms of consumer prices, job losses, relocation and inflation: The issue is whether achieving enhanced water quality is commensurate with the investment of public and private funds. Although management will be somewhat hampered by government involvement in industry and pollution control will obviously cost money, there is no viable alternative to an effective effort to clean up our environment. (Wilson-Florida)
W80-05374

COMMENTS ON 'FEDERAL RESERVED WATER RIGHTS',
Debevoise and Liberman, Washington, DC.
J. C. Muys.
Denver Law Journal, Vol 54, No 3-4, p 493-498, 1977.

Descriptors: *Reservation doctrine, *Federal-state water rights conflicts, *Water resources development, Planning, Administrative agencies, State governments, Water rights, Water resources, Water allocation(Policy), Water demand.

In its 1970 report to Congress and the President, the Public Land Law Review Commission evaluated the problems posed by the federal water rights reservation doctrine. The doctrine may disrupt established water right priority systems and destroy vested water rights under state law. Moreover, the uncertainty generated is an impediment to sound planning for future water resources development. Legislative action is needed to dispel this uncertainty and provide the basis for cooperative water resources development planning between the federal government and the state with federal lands. This legislation should include: (1) a requirement that federal land agencies ascertain and give notice of their projected water requirements for the next forty years; (2) establishment of a procedure for determining the reasonableness of diverted water quantities; (3) require, as a condition to claims of reserved water rights, a statement of prospective water requirements, and (4) compensation where utilization of the implied reservation doctrine interferes with vested state water rights. (Wilson-Florida)
W80-05375

A REAL LIVE PROBLEM OR TWO FOR THE WANING ENERGIES OF FRANK J. TRELEASE,
Washington Univ., Seattle.
C. Corker.
Denver Law Journal, Vol 54, No 3-4, p 499-505, 1977.

Descriptors: *Reservation doctrine, *Water allocation(Policy), *Federal-state water rights conflicts, Legal aspects, Federal government, Water policy, Diversion, Administrative agencies, State governments, Federal reservations.

All the water diverted as a reslt of the reservation doctrine, excluding Indian water rights, is minimal. The reservation doctrine is essentially mythical for two reasons. First, all water rights have to be administered. Federal officials and agencies have never been created to administer water rights. Federal judges cannot administer water rights without a federal administrator. On the other hand, every state where water is scarce has adopted and administered such a system. Second, water law is not a discrete and separate branch of the law, but is a part of real property law. Most transfers of water rights are accompanied by transfers of land. Practically, if not conceptually, real property law is far beyond the power of Congressional preemption. Moreover, there is no general federal common law. There is no direct danger to water rights as a result of the reservation doctrine. There may be danger instead to the federal system. (Wilson-Florida)
W80-05376

SAVING THE COAST: THE CALIFORNIA COASTAL ZONE CONSERVATION ACT OF 1972.
Golden Gate Law Review, Vol 4, No 2, p 307-352, Spring 1974.

Descriptors: *California, *Shore protection, *Conservation, *Zoning, Shores, Land development, Resources development, Seashores, Coastal plains, Legislation, Permits.

The 1972 California Coastal Zone Conservation Act (CCZCA) is a public response to widespread construction along the California coastline. Although most of the coastline is privately held, California citizens and the courts are recognizing a valid public interest in coastal resources. To protect coastal resources until a comprehensive plan can be developed, an interim permit procedure has been established. Analyzed are the interim permit control provisions of the CCZCA, with particular emphasis on: (1) the necessity of compliance with permit provisions; (2) types of permits required; (3) criteria for approval or disapproval of permit applications; and (4) constitutional issues raised by the CCZCA. At the end of the planning phase a permanent coastal commission will be established to monitor development and update plans. The final coastal regulation plan should withstand judicial scrutiny. (Schwerer-Florida)
W80-05377

COASTAL LAND MANAGEMENT IN CALIFORNIA,
Houston Univ., TX.
G. L. Finnell, Jr.
American Bar Foundation Research Journal, Vol 1978, No 4, p 647-750, Fall 1978.

Descriptors: *California, *Land use, *Coasts, *Shore protection, Legislation, State governments, Coastal engineering, Management, Administrative agencies, Local governments, Regulation.

The nation's most significant experiment in coastal land management, the one likely to affect the most people's lives, is now under way in California. The program will most likely have national, and perhaps even international, consequences. The 1976 California Coastal Act (1976 Act) continues a coastal planning and regulatory process that began in 1972 when California's citizens approved Proposition 20. Proposition 20 resulted in the creation of the California Coastal Zone Conservation Commission and six regional commissions to accomplish two major objectives: (1) study the coastal zone and prepare the California Zone Conservation Plan; and (2) regulate development by permit in the coastal zone during the studying and planning period. The 1976 Act continues the two functions of coastal plan preparation and interim regulation started in 1972. But local governments are given a stronger role under the 1976 Act, which only sets forth general policies, directing local governments to prepare a local coastal program. The completed local coastal program is submitted to the regional commission that certifies program conformity with the policies of the 1976 Act. (Wilson-Florida)
W80-05378

PROBLEMS AND PROSPECTS OF COASTAL ZONE MANAGEMENT: AN ENVIRONMENTAL VIEWPOINT,
Natural Resources Defense Council, New York.
S. Chasis.
Coastal Zone Management Journal, Vol 6, No 4, p 273-280, 1979.

Descriptors: *Coasts, *Shore protection, *Land use, Federal government, Legislation, Decision-making, Environmental effects, Administrative decisions, Administration, State governments, Local governments.

The 1972 Coastal Zone Management Act (Act) is not effectively addressing the problems Congress recognized when the law was passed. It is not ensuring protection of our valuable coastal resources, mainly because the Act has been interpreted as a neutral planning process which emphasizes decision-making procedures at the expense of policy substance. Planning and management do not exist for their own sakes; procedures without substantive content are meaningless. Many states structures now exist that begin to deal with coastal problems. Current management problems are discussed, and recommendations to strengthen coastal zone management programs are presented. One source of the problems is the statute itself - the stated purposes are too broad. Also, implementation at the federal and state level has not been as vigorous as it should have been. More vigorous implementation is necessary to ensure the original goals of the Act are met. A national policy must be established and implemented. The principles on which such a policy should be based are listed. (Daniels-Florida)
W80-05379

PROLEGOMENA TO THE DISPUTES SETTLEMENT PART OF THE LAW OF THE SEA CONVENTION,
A. O. Adede.
New York University Journal of International Law and Politics, Vol 10, No 2, p 253-393, Fall 1977. 2 App.

Descriptors: *Law of the sea, *United Nations, *Remedies, Treaties, Conferences, Decision-making, International law, International waters, Water law, Negotiations.

Most of the substantive treaty negotiations before the United Nations Conference (Conference) on the Law of the Sea have been undertaken in informal meetings of the Conference committees. This article provides an analysis of Part XV of the current draft Law of the Sea Convention (The Informal Composite Negotiating Text) which deals with disputes settlement. Documents containing draft articles on the subject of disputes settlement produced by each session of the Conference are analyzed. The key issues are identified, and their treatment is analyzed at the various stages of the negotiations. Disputes settlement was dealt with in two stages at the Conference. First was the work of the Informal Working Group. The second stage was the informal meetings of the plenary Conference representing the official treatment of the subject. The Informal Working Group made a significant contribution to the development of the disputes settlement treaty articles. (Daniels-Florida)
W80-05380

STATE-LOCAL RELATIONS IN COASTAL ZONE MANAGEMENT IMPLICATIONS FOR CHANGE,
California Univ., San Diego. Inst. of Marine Resources.
J. Sorensen.
Coastal Zone Management Journal, Vol 6, No 4, p 295-302, 1979.

Descriptors: *State governments, *Local governments, *Governmental interrelations, *Shore protection, Federal government, Legislation, Coordination, Coasts, Planning, Management, Land use.

Changes in intergovernmental relations have been one of the main effects of the Coastal Zone Management Act (Act). A rearrangement in state-local government relations is one of the Act's major achievements. However, state-local relations could be improved by legislative amendments. One type of arrangement dominates the state-local relationships: Collaborative Planning Process (CPP). The CPP is not the most appropriate coastal management implementation arrangement for all states. The Act should be redrafted to clarify Congressional intent in coastal zone management. The Act should recommend to states using or considering CPP that the process incorporates three additional state powers. Additional amendments should require the Office of Coastal Zone Management to review substantial changes in local coastal plan components of a state's approved program. The Act's two greatest impacts, in states with CPP, have been to improve local governments planning capabilities and improved communication between state and local governments. (Daniels-Florida)
W80-05381

MANAGEMENT OF LIVING RESOURCES IN THE NORTHEAST PACIFIC AND THE UNILATERAL EXTENSION OF THE 200-MILE FISHERIES ZONE,
Washington Univ., Seattle. Inst. for Marine Studies.
D. Fluharty, and C. Dawson.
Ocean Development and International Law Journal, Vol 6, p 1-72, 1979. 19 Tab, 1 Bib.

Descriptors: *Jurisdiction, *Resources development, *Fisheries, *Law of the Sea, Resources allocation, International waters, International Law, Regional analysis, Regional development, Management, Resources, Oceans.

The emergence of a 200-mile economic zone, within which coastal states have exclusive control over marine resources, scientific research and pollution, will produce immediate and interacting effects. The need will intensify for increased bilateral and multilateral consultations, and a new level of coordination to cope with impending changes in use patterns. Recent demands for expanded jurisdiction seldom consider the policies and organizational networks needed for coordinated management and conflict resolution on regional or subregional levels. The need for a policy-oriented approach to multiple usage problems is addressed, with the world's oceans divided into marine regions. A marine regiona is a marine area in which the pattern of management problems posed by different activities is at least analytically separable from the rest of the world ocean. With the North Pacific Ocean as an example, the different approaches are analyzed which coastal states within marine regions can use to determine 'net benefit', corrdinate management, and resolve regional conflicts. (Daniels-Florida)
W80-05382

LIQUEFIED NATURAL GAS TERMINAL SITING IN THE CALIFORNIA COASTAL ZONE: THE SCOPE OF PERMISSIBLE STATE AUTHORITY,
J. C. Arnold.
Pacific Law Journal, Vol 9, No 2, p 1069-1113, July 1978.

Descriptors: *California, *Natural gas, *Sites, *Shore protection, Liquids, Energy, Facilities, Coasts, Legal aspects, State governments, Environmental effects, Federal government.

With the enactment of the 1977 Liquefied Natural Gas Terminal Act (Act) California has committed itself to the importation by sea of liquefied natural gas as a primary energy source for the foreseeable future. Further siting criteria are necessary to govern construction of additional liquid natural gas facilities in the California coastal zone. Regardless of whether the state or federal government has the power to establish ultimate siting criteria for import terminals, the nature of liquid natural gas and the potentially disastrous impact of a massive accident compel governmental consideration of the siting issue. Onshore as opposed to offshore siting,

and remote as opposed to populated site locations, are topics of current and continued public concern that must eventually be dealt with at the federal or state level. The Act raises the question of whether the state may constitutionally enforce the statute in the face of federal preemption. The present federal statutory scheme indicates an intent that states retain a significant degree of control over liquid natural gas facility siting. (Daniels-Florida)
W80-05383

COASTAL ENERGY IMPACT PROGRAM: REGULATIONS TO ESTABLISH THE OUTER CONTINENTAL SHELF (OCS) STATE PARTICIPATION GRANT PROGRAM (FINAL RULES).
Department of Commerce, Washington, DC.
Federal Register, Vol 45, No 14, p 4306-4311, January 21, 1980.

Descriptors: *Grants, *Continental shelf, *Resources development, *Governmental interrelations, State governments, Oil, Leases, Government finance, Management, Planning, Environment.

These final regulations describe administrative procedures for implementing section 308(c) (2) of the 1972 Coastal Zone Management Act. The Outer Continental Shelf State Participation Grant Program is established which provides financial assistance for coastal state participation in policy, planning, and managerial decisions related to continental shelf oil and gas resources management. The Assistant Administrator is authorized to make grants to coastal states likely to be affected by Outer Continental Shelf energy activity, provided these states are eligible to receive Coastal Energy Impact Program assistance. These grants are intended to pay for state participation in formulating leasing programs, reviewing environmental impact statements, making recommendations for exploration and development, and analyzing program data. Each state receives an equal minimum share. After this, remaining funds are alloted according to a formula. Each state has thirty days to comment upon the formula applied to it. The regulations also set out the proper contents of a grant application. Each state has 120 days to apply for its allotment, or it reverts back to the Assistant Administrator for redistribution. (Tabano-Florida)
W80-05384

FISHERMEN'S CONTINGENCY FUND (FINAL REGULATIONS).
Department of Commerce, Washington, DC.
Federal Register, Vol 45, No 17, p 6062-6078, January 24, 1980.

Descriptors: *Compensation, *Continental shelf, *Damages, *Commercial fishing, Fishing gear, Governments, Assessments, Leases, Easements, Permits.

The regulations establish procedures for administering the Fishermen's Contingency Fund. This Fund compensates fishermen for eligible claims for actual and consequential damages. Lost profits due to damages to, or loss of, fishing vessels or gear by activity associated with oil and gas exploration, development, or production on the Outer Continental Shelf are recoverable. The Fund is set up in the United States Treasury and consists of nine area accounts. Assessments are made against leases, easements, and exploration permits relating to the Outer Continental Shelf in order to fund each area account. Eligibility for compensation requires that the claimant be a commercial fisherman. The procedure for computation of damages is set forth. The regulations also set forth instructions for filing claims. The chief of the Financial Services Dicision and the Secretary of the Interior both take part in processing claims. The burden of demonstrating eligibility for, and the amount of, compensation is upon the claimant. Costs of the proceeding are paid by the person responsible for the damage. The government is subrogated to any other rights the claimant may have against any person in another proceeding. (Tabano-Florida)
W80-05385

RATIONAL DEVELOPMENT OF OUTER CONTINENTAL SHELF OIL AND GAS,
Senate, Washington, DC.
H. M. Jackson.
Oregon Law Review, Vol 54, No 4, p 567-581, 1975.

Descriptors: *Continental shelf, *Resources development, *Oil, *Gases, Exploration, Legislation, Federal government, Environmental effects, State governments, Energy, Programs.

The United States domestic energy production effort should be directed toward increasing the rate of exploration and development on the Outer Continental Shelf (OCS). Obstacles to OCS gas and oil development are technological, economic, environmental, legal and administrative. Policy issues are: (1) development rate and location; (2) environmental safeguards; (3) role of and impact on coastal states; (4) extent of federal government participation; (5) access to industry information; and (6) resource allocation. Congress must update the 1953 Outer Continental Shelf Lands Act to provide authority and guidelines for development activity. The history of the OCS Act and OCS resource development is examined. The OCS contains large amounts of undiscovered oil and gas resources, and demonstrated reserves of almost one billion barrels of oil and one trillion cubic feet of gas. The major provisions of the proposed 1975 Energy Supply Act are discussed. This Act contains needed changes in the law that allow people to retain control over their resources. (Daniels-Florida)
W80-05386

TRENDS IN ENVIRONMENTAL LITIGATION: A SURVEY OF 1976 NEW JERSEY JUDICIAL DECISIONS,
L. Goldshore.
Rutgers Camden Law Journal, Vol 9, No 1, p 21-59, Fall 1977.

Descriptors: *New Jersey, *Shore protection, *Water resources, *Land use, Environmental effects, Coasts, Wetlands, Legislation, Regulation, Public access, Environmental control, Administrative agencies, Judicial decisions.

In 1976, New Jersey courts dealt with a variety of environmental issues: (1) the balancing and integration of environmental goals with other societal needs; (2) cost allocation for attaining governmental objectives; (3) the validity of environmental protection statutes and regulations; and (4) the application of general statutes to specific environmentally-related factual contexts. The Department of Environmental Protection (DEP) wetlands hearing regulations were upheld against attack by a conservation group. The state's supreme court decided that the public trust doctrine prohibited a municipality from discriminating between residents and non-residents. As to water resources issues, the New Jersey courts heard cases dealing with thermal pollution, oil spills, flooding and sewerage authorities. There were several exclusionary zoning cases, in which municipalities argued that environmental considerations prohibited development of low-cost housing. As to outdoor recreational issues, the constitutionality of statutory provisions for selecting members of the Fish and Game Council were upheld. Statutes were interpreted dealing with out-of-state solid waste, the Solid Waste Management Act, and the Solid Waste Utility Control Act. (Wilson-Florida)
W80-05387

GEOTHERMAL LEASING,
R. J. Werner.
Oregon Law Review, Vol 54, No 4, p 623-641, 1975.

Descriptors: *Water resources development, *Leases, *Geothermal studies, *Steam, Legislation, Federal government, Legal aspects, Resources, Public lands, Energy, Water resources.

Geothermal steam has tremendous electrical energy potential. Concentrations of geothermal energy, economically feasible to extract, are in geothermal reservoirs. There are three requirements geothermal reservoirs must meet for economical exploitation. By 1985, ten percent of the United States (U.S.) energy needs could be produced from these reservoirs. Exploration presently is occuring in some western states. Before 1970, no statutory authority permitted the disposition of geothermal resources on public lands, where much geothermal potential exists. The 1970 Geothermal Steam and Associated Geothermal Resources Act (Act) encouraged development through a system of privately held leases. The Act provides guidelines to what lands are subject to leasing. Lease holders are limited to U.S. citizens, associations of citizens, corporations and governmental units. A 'grandfather' clause is included. Certain aspects of the Act's regulatory provisions are discussed: extraction of by-products; minerals excepted from leases; mineral lease conversion; effect on state water laws; surface use; and lease procedures and assignment. Certain lease terms are discussed: duration; leasehold area; rents and royalties; readjustment; and other miscellaneous terms. It is unclear whether minerals reserved to the U.S. in patents previously issued apply to geothermal resources. (Daniels-Florida)
W80-05388

CONTROLLING MARINE POLLUTION - WORLD TASK OR NATIONAL.,
Texas Univ. at Austin.
W. L. Butte.
Stanford Journal of International Studies, Vol 8, p 99-112 Spring 1973.

Descriptors: *Oceans, *Pollution abatement, *International waters, *Law of the sea, United Nations, United States, International law, Legislation, Conferences, Regimes, Negotiations.

An international solution to ocean pollution will create problems of indefinite delay and inconclusive results. The language used in Article 25 of the 1958 Geneva Convention on the High Seas is an example of the problems inherent in looking for an international solution. The 1972 United Nations (U.N.) Conference on the Human Environment in Stockholm attempted to deal with marine pollution. It could not agree on anything specific or concrete. Its Declaration is not binding on any states. The preparatory work undertaken for the 1973 U.N. Conference on the Law of the Sea indicates problem-solving will be attempted by creating new committees and agencies. Direct confrontations will be avoided. Generalized objectives would not be binding. Alternative methods to the U.N. machinery to solve ocean pollution are compared. These include multilateral, bilateral or unilateral action. Developed nations must solve ocean pollution, either alone or through negotiations among the industrialized states. (Daniels-Florida)
W80-05389

U.S. POSITION ON NEGOTIATIONS CONCERNING THE GREAT LAKES,
Department of State, Washington, DC.
D. Burns.
Syracuse Journal of International Law and Commerce, Vol 1, No 2, p 199-204, Fall 1973.

Descriptors: *Great Lakes, *United States, *Canada, *Boundary disputes, International Joint Commission, Negotiations, Boundaries(Surface), Water pollution, Treaties, Water pollution control, Water quality control, Monitoring.

Attempts at resolution of boundary water problems have played a dominant role in United States-Canadian relations over the years. In 1909, the two countries concluded the Boundary Waters Treaty (Treaty). The 1909 Treaty created the International Joint Commission (Commission), which has the principle function of passing on applications to use, divert, or obstruct waters covered by the Treaty. Article IV of the Treaty provides that the waters covered therein shall not be polluted by either side. Shortly after its establishment, the Commission was requested to look into questions of water pollution. The Commission has made recommendations to both governments with respect to various questions of boundary waters pollution. Both par-

ties have agreed that the Commission should monitor water pollution. The Commission's 1970 report is the basis on which the Great Lakes Duality Agreement has been negotiated. The principle recommendations of the Commission are: (1) adoption of common water quality objectives; and (2) continued Commission monitoring. (Daniels-Florida)
W80-05390

COMPARATIVE NATIONAL LEGISLATION ON OFFSHORE POLLUTION,
United Nations Secretariat. Office of Legal Affairs.
M. Hayashi.
Syracuse Journal of International Law and Commerce, Vol 1, No 2, p 250-256, Fall 1973.

Descriptors: *Foreign countries, *Oil pollution, *Continental shelf, Water pollution, Environmental control, Legal aspects, International commissions, Water pollution control, International law, Oil spills.

National legislation on marine pollution can be classified into four types: (1) provisions concerning the development of continental shelf resources; (2) laws enacted pursuant to the 1954 London Convention for the Prevention of Pollution of the Sea by Oil (London Convention); (3) those containing the elements covered by the London Convention and the 1969 Brussels Convention on oil pollution casualties; and (4) laws which do not fall into the above three categories. In the first category, most of the provisions are based on the Geneva Convention on the Continental Shelf. This states that continental shelf exploration must not result in unjustifiable interference with navigation, fishing or conservation. Nations with this type of legislation include Italy, Sweden, Venezuela, and the United States. The United States also has legislation that compacts with the London Convention. Similar laws are in effect in France, Ghana, Kuwait, and Spain. The third category consists of more comprehensive laws, such as the British Oil in Navigable Waters Act of 1971. Lastly, some national laws have unique features not present in the other categories. An example is the Australian Navigation Act. (Wilson-Florida)
W80-05391

THE RIGHTS AND LIABILITIES OF A MINERAL OWNER CONCERNING THE USE OF WATER,
K. C. Raney, Jr.
South Texas Law Journal, Vol 17, No 3, p 510-524, 1976.

Descriptors: *Texas, *Mineral industry, *Water rights, *Water allocation(Policy), Water demand, Judicial decisions, Mining, Subsurface waters, Surface waters, Mine water, Water law.

The increased mining of hard minerals in Texas has created great conflict between the rights of mineral owners and other water users involving the same supply of water. The use of water by mineral producers has created some novel situations that past legislatures and courts could not have anticipated. A mineral owner's right to use water can be determined by classifying water into two categories, either subterranean water or non-subterranean water. Subterranean water is either an underground stream or percolating water. This distinction is important with respect to claims of water ownership. With percolating water, the problem is one of determining rights between users. As a general rule, a surface owner has the right to use the surface water on his property. The issue remains whether a mineral lessee has the right to use or drain surface water as a reasonable use of the surface estate in mining his claim. The right to mine and the right to use water must be reconciled where conflicting to provide an effective water policy. (Wilson-Florida)
W80-05392

JUDICIAL DEFERENCE IN THE SUBMERGED LANDS CASES,
Vanderbilt Univ., Nashville, TN.
J. I. Charney.
Vanderbilt Journal of Transnational Law, Vol 7, No 2, p 383-455, Spring 1974.

Descriptors: *Judicial decisions, *Beds under water, *Legal aspects, Constitutional law, Constraints, Adoption of practices, Adjudication procedure, Legal review, Jurisdiction, Water law.

In many areas of foreign relations, the United States (U.S.) Supreme Court has determined the judiciary should exercise restraint and defer to the wishes of the Executive Branch. This judicial restraint and deference may be appropriate in submerged lands cases. The Supreme Court has failed to identify factors that require judicial restraint. The primary subject matter areas in which judicial restraint has been exercised are recognition, sovereign immunity, state acts, treaty interpretation and territorial questions. Twelve significant court decisions in the submerged lands dispute are reviewed. Initially, the Supreme Court exercised restraint in submerged lands disputes, believing their decisions might affect the U.S. territorial boundary. This restraint became tempered; most recent decisions minimize deference to the Executive branch. A review of the submerged lands issues indicates deference should play no role in submerged lands cases. (Daniels-Florida)
W80-05393

INTERNATIONAL STRAITS, GLOBAL COMMUNICATIONS, AND THE EVOLVING LAW OF THE SEA,
W. G. Grandison, and V. J. Meyer.
Vanderbilt Journal of Transnational Law, Vol 8, No 2, p 393-449, Spring 1975.

Descriptors: *Law of the Sea, *Communication, *Straits, International law, International waters, Navigation, Legal aspects, Oceans, Jurisdiction, Regimes.

Extending territorial seas to twelve miles will cause over 100 straits to be overlapped by the territorial sea. Existing international legal norms preserving navigational freedom and overflight between ocean areas will be altered. Controversy ensues over what legal regime should govern the traffic in these straits. Communications issues raised by the proposed extention are focused on. A legal regime is suggested to resolve current legal controversies, and to provide continuity in the law governing international communications within these straits. The evolving law of the sea and the events leading to the straits controversy are examined. The role of straits in ocean communications, the interests of states relying on the use of straits for communications and the interest of coastal states bordering straits are explored. There are general legal trends supporting global communications. Different legal approaches to the control and regulation of communication and to the allocation of authority to control communication in straits are examined. A new straits regime must guarantee to all nations use of and access to communications media in straits. (Daniels-Florida)
W80-05394

CANADA'S INTERESTS AS REGARDS PROTECTION AND REGULATION OF THE GREAT LAKES,
Department of External Affairs, Ottawa (Ontario). Bureau of Economic and Scientific Affairs.
K. Wardroper.
Syracuse Journal of International Law and Commerce, Vol 1, No 2, p 205-222, Fall 1973.

Descriptors: *Canada, *Great Lakes, *Water pollution control, *United States, International Joint Commission, Water pollution, Boundaries(Surfaces), United States, Negotiations, Treaties, Environmental control.

In 1964 the Boundary Waters Treaty launched the International Joint Commission into an intensive examination of the water conditions in the lower Great Lakes. In 1970 the Commission reported there was extensive tran-boundary pollution in the area. This report also proposed five general objectives to which both the United States and Canada should address themselves. These objectives state that the waters of the Great Lakes should be: (1) free from substances or solids attributable to municipal discharges; (2) free from floating debris and other discharges in unsightly or deleterious amounts; (3) free from odor-producing material attributable to municipal discharges; (4) free from nutrients; and (5) free from hazardous and toxic substances. These general objectives, in order to be translated into meaningful intergovernmental undertakings, have been presented as numerous specific objections. Under a proposed agreement, the governments concerned would exchange commitments to carry out a variety of pollution control programs. These programs include: (1) construction of treatment facilities; (2) reduction of phosphorus discharges; (3) elimination of mercury from discharges; and (4) control of pesticide pollution. (Wilson-Florida)
W80-05395

ENVIRONMENTAL LAW - A SURVEY OF INTERNATIONAL MARINE POLLUTION CONTROL: PRELUDE TO GENEVA,
P. B. Barr, Jr.
Vanderbilt Journal of Transnational Law, Vol 8, No 2, p 477-492, Spring 1975.

Descriptors: *Water pollution control, *International commissions, *Law of the sea, *United Nations, International law, Treaties, Environmental control, International waters, Water pollution, Foreign countries, Oceans.

Treaties, conventions, and agreements relative to marine pollution are myriad. Summaries of modern international efforts to prevent pollution begin with the 1954 Convention for the Prevention of Pollution of the Sea by Oil. Several United Nations Conventions drafted at the First Law of the Sea Conference, now in force, incorporate provisions designed to protect the marine environment. Nations that share marine resources because of geographical proximity have begun to recognize common pollution problems. An example of such a regional agreement is the Committee on the Challenges of a Modern Society established the North Atlantic Treaty Organization in 1969. Marine pollution has recently become an area of cooperation between the United States and the Soviet Union. A 1972 agreement anticipates joint study and development of coordinated projects in basic and applied sciences. Non-governmental bodies, such as the International Council of Scientific Unions, have also become involved in prevention of marine pollution. Recent United Nations approaches include the 1972 Stockholm Conference on the Human Environment and the 1974 Conference on the Law of the Sea. (Wilson-Florida)
W80-05396

NATIONAL WATER POLICY IN THE WAKE OF UNITED STATES V. NEW MEXICO,
New Mexico Water Resources, Santa Fe.
R. A. Simms.
Natural Resources Journal, Vol 20, No 1, p 1-16, January 1980.

Descriptors: *Federal reservations, *Federal-state water rights conflicts, *Reservation doctrine, *Water allocation(Policy), Judicial decisions, Water policy, Water rights, Federal government, Legal aspects, Water users, State governments.

In a 1978 decision, the United States (U.S.) Supreme Court limited federal reserved right claims to the Rio Mimbres drainage of the Gila National Forest. They were limited to an amount of water necessary to satisfy the purposes for which the forest lands were withdrawn from the public domain. The federal government has reacted by reassessing its posture in water rights litigation in various western states, and by creating a conceptually new basis upon which to assert its claims. The U.S. Solicitor General has asserted that the U.S. has always retained a residual right to use nonnavigable western waters for congressionally mandated purposes, independently of the reservation doctrine. This doctrine of 'non-reserved federal water rights' attempts to circumvent rather than adhere to the Court's decision. Moreover, President Carter has made assurances that his water policy reforms will not undermine state preroga-

tives in water rights administration. When acting on the President's water policy recommendations, Congress should not ignore the views of western water officials. (Wilson-Florida)
W80-05397

ABORIGINAL WATER RIGHTS,
Yegge, Hall and Evans, Denver, CO.
J. L. Merrill.
Natural Resources Journal, Vol 20, No 1, p 45-70, January 1980.

Descriptors: *Water rights, *Federal reservations, *Indian reservations, Federal government, State governments, Water demand, Water users, Legal aspects, Prior appropriation, Federal-state water rights conflicts.

An aboriginal water rights, one which was the first of its kind in a region, is based on the water use from earliest days. A water right which predates federal sovereignty is sufficient to render that right aboriginal vis-a-vis the United States. Aboriginal rights constitute a potentially great threat to present water users because they may displace federal water rights and those held under state prior appropriation law. Aboriginal water rights have greatest potential impact in the western states. Aboriginal rights were judicially decreed in a 1935 case and exist as pueblo water rights in California and New Mexico. Little else has been heard about them until recently. Native American Indian tribes have begun to claim they have always held and now hold aboriginal water rights. Several aspects of aboriginal water rights deserve exploration: (1) their relationship to the federal Winters Doctrine; (2) state court jurisdiction over aboriginal rights; (3) groundwater; and (4) the uses to which these waters might be put. (Wilson-Florida)
W80-05398

CONSIDERATIONS AND CONCLUSIONS CONCERNING THE TRANSFERABILITY OF INDIAN WATER RIGHTS,
J. D. Palma.
Natural Resources Journal, Vol 20, No 1, p 91-100, January 1980.

Descriptors: *Water rights, *Federal reservations, *Water transfers, *Indian reservations, Federal government, Federal-state water rights conflicts, Judicial decisions, Water allocation(Policy), Prior appropriation, Legal aspects, Water demand, Water users.

As a consequence of the United States (U.S.) Supreme Court decision in Colorado River Water Conservation District v. U.S., there has been intensified adjudication of Winters Doctrine water rights between the states and the U.S. and/or their Indian wards. Courts have applied various standards to determine the water quantity reserved under the Winters Doctrine. Regardless of what test is utilized to quantify these Indian water rights, the tribes will obtain prior and, in most cases, paramount rights to vast water quantities. An important issue is the transferability of Indian water rights to new uses within the Indian reservation boundaries. Since most of the water claimed under the Winters Doctrine has not yet been put to beneficial use, there is a question about the water quantity transferable to a new use. An additional issue concerning the transferability of Winters rights involves the rights of purchasers of land formerly a part of the reservation. (Wilson-Florida)
W80-05399

RES JUDICATA - WILL IT STOP INSTREAM FLOWS FROM BEING THE WAVE OF THE FUTURE.,
Department of the Interior, Albuquerque, NM. Field Solicitor's Office.
H. A. Ranquist.
Natural Resources Journal, Vol 20, No 1, p 121-151, January 1980.

Descriptors: *Prior appropriation, *Streamflow, *Water rights, Indian reservations, State governments, Streams, Judicial decisions, Water distribution(Applied), Legal aspects, Diversion.

The instream flows issue is arising in water rights litigation in the west. Until recently the western states have denied that instreams had any place in the appropriation system. As the move to establish instream flows increases, present water users are rising in opposition. A barrier which opponents of instream flows will erect is the claim that western streams are fully appropriated and adjudicated, leaving little or no room for the exercise of instream flows. They argue that the legal bar to further litigation under the doctrines of res judicata and collateral estoppel will shield against instream water claims. However, the unique nature of water and the water adjudication process, particularly quit title proceedings, results in many water uses not being subject to bars against further litigation. If diversion from streams is restricted to effective beneficial use, water will be available to establish instream flows in some streams despite the applicability of the bar to further action. (Wilson-Florida)
W80-05400

6F. Nonstructural Alternatives

SAVING THE COAST: THE CALIFORNIA COASTAL ZONE CONSERVATION ACT OF 1972.
For primary bibliographic entry see Field 6E.
W80-05377

6G. Ecologic Impact Of Water Development

WATER AND THE ENVIRONMENT -- A SCOTTISH SOLUTION,
Cutherbertson (Rober H.) and Partners, Edinburgh (Scotland).
W. P. McLeish, and D. Mackie.
Water, No 31, p 11-14, March 1980. 5 Fig, 3 Ref.

Descriptors: *Environmental effects, *Scotland, *Water supply development, Water supply, Reservoirs, Water demand, Project benefits, Land use, Water sources, Aqueducts, Ecology, Impact studies, Evaluation, Analytical techniques, Classification.

The findings and methods used in a comparative environmental examination of the three preferred schemes for the treating of water from new sources and conveying it to selected distribution points in Scotland are discussed. The three schemes are: the Clyde scheme, based on a large regulating reservoir on an upper tributary; the fourth scheme based on two regulating reservoirs; and the Tay scheme based on direct abstraction from the river. The study was designed to gather information on the characteristics of the areas involved, the activities in those areas, the impacts of the proposals on these characteristics and activities, and the capability of the proposals for modification to elimanate environmental problems. The information gathered from various agencies was combined to form an 'impact matrix' for each subarea involved. Impacts were classified as long term benefit, short term benefit, no benefit or disbenefit, short term disbenefit, or long term irreversible disbenefit. Results show that in environmental terms, the Tay scheme is the most desirable plan due to the fact that it will not produce long-term deleterious irreversible effects. Results also show that the Clyde scheme would have the most damaging environmental effects. (Seigler-IPA)
W80-05117

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST, EXECUTIVE SUMMARY,
Enviro Control, Inc., Rockville, MD.
W. Nelson, G. Horak, M. Lewis, and J. Colt.
U.S. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS/-76/28. December, 1976. 14 p.

Descriptors: *Rocky Mountain region, *Pacific Northwest U.S., *Wildlife habitat, *Water resources development, Streamflow, Wildlife, Dams, Alteration of flow, Fisheries, Water resources, *Altered streamsflow, Environmental effects, Ecology.

A detailed summary, evaluation, and a series of recommendations is provided on the impacts of 109 instream flows distributed in nine western states. The introductory discussion explains the background, purpose, and methodology of the research. The more significant conclusions are summarized in the next section. These conclusions are utilized in the final section as the basis for key recommendations for improving the process of instream flow reservation and implementation. (Steiner-Mass)
W80-05323

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE. PART B: CALIFORNIA, EXECUTIVE SUMMARY,
Jones and Stokes Associates, Inc., Sacramento, CA.
C. Hazel.
U.S. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-76/32. December, 1976. 14 p.

Descriptors: *California, *Wildlife habitat, *Water resources development, *Stream flow, Wildlife, Dams, Alteration of fflow, Fisheries, Water resources, Fish management, *Altered streamflow, Environmental effects, Ecology.

Forty-six projects were investigated and evaluated to identify the discernible effects of post-project flows on pre-project fish and wildlife and to evaluate the success and effectiveness of various methodologies used to predict project effects. Each project was reviewed and evaluated through a literature search, review of files, interviews with project biologists, and visits to the project site. Conclusions were: The methodology for obtaining instream flows for fish and wilflife in California are insufficiently documented and publicized. Information about the quantity of water potentially available for fish and wilflife was usually not made available to the fisheries agencies. Average monthly post-project flows of about 0.7 or less of the pre-project flow during critical periods are degrading to fisheries and decreases to 0.3 or less severly damage or lead to the extinction of the principal fisheries. Projects that divert water from the reservoir pool are most damaging to fish. On the other hand, projects that utilize the river channel to convey project water to users are most likely to maintain or improve the pre-project fishery. (Steiner-Mass)
W80-05324

THE URBAN COAST FROM A NATIONAL PERSPECTIVE,
National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-05363

COASTAL ZONE MANAGEMENT: THE FIRST FIVE YEARS AND BEYOND,
National Oceanic and Atmospheric Administration, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05366

A PETROLEUM INDUSTRY PERSPECTIVE ON FEDERAL COASTAL ZONE MANAGEMENT,
American Petroleum Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05367

COASTAL LAND MANAGEMENT IN CALIFORNIA,
Houston Univ., TX.
For primary bibliographic entry see Field 6E.
W80-05378

7. RESOURCES DATA

7B. Data Acquisition

AN INVESTIGATION OF SATELLITE-RADAR CORRELATION FUNCTIONS,
Eddy (Amos) Inc., Norman, OK.
L. A. Hembree.
Available from the National Technical Information Service, Springfiled, VA 22151 as PB80-176001, Price codes: A11 in paper copy, A01 in microfiche.

Descriptors: *Radar, *Remote sensing, *Satellites(Artificial), *Rainfall, Montana, Model studies, Mathematical models, Storm structure, Meteorology, Methodology, Analysis, Infrared radiation, Rain gages, Weather data, Precipitation(Atmospheric), Weather patterns.

Space time correlation fields were used to combine radar and satellite data sets to improve estimates of surface precipitation. Data used in the study included rain gage, radar, and satellite observation derived from the HIPLEX (High Plains Cooperative Program) project at Miles City, Montana. The radar data consisted of digitized 5 cm radar returns from 5 minute scans of 12 elevation angles, however, only the 1 degree angle was used. Satellite data consisted of visible reflectance and IR radiance. Temperature gradients were calculated since the highest temperature gradient should be associated with higher rain rates. Four convective complexes were analyzed in detail using a multivariate optimal interpolation objective method of analysis. The correlation fields were used to represent the storm structures as implied by observed data. A four-dimensional Gaussian damped cosine function with parameters reflecting storm characteristics was used to model the correlation fields. Results show that suitable correlation fields can be obtained with respect to auto-correlation fields. For cross-correllation fields, which tend to be multimodal, a more general correlation model may be needed. Correlation values of 0.6 between satellite and radar rain data were reached at the appropriate space-time lags for maximizing pattern correspondence. The potential value of the multivariate objective analysis methodology is established. (Seigler-IPA)
W80-05110

USERS GUIDE FOR THE ANALYSIS AND INTERPRETATION OF SATELLITE IMAGERY ON THE HIGH PLAINS SUMMER CLOUD AND MESOSCALE SYSTEMS,
Water and Power Resources Service, Denver, CO. Div. of Research.
D. A. Matthews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175987, Price codes: A03 in paper copy, A01 in microfiche. Report, January 1980. 44 p, 17 Fig, 2 Tab, 17 Ref.

Descriptors: *Remote sensing, *Satellites(Artificial), *Cloud physics, *Precipitation(Atmospheric), Meteorological data , Weather data, Synoptic analysis, Weather modification, Cloud seeding, Storms, Montana, Texas, Kansas, Atmospheric physics, Air temperature, Air circulation.

Examples of typical cloud types and mesocale organized cloud systems which affect summertime precipitation on the High Plains are illustrated and discussed to aid in the interpretation of satellite imagery and to provide a guide for uniform classification. The examples are taken from conditions over the High Plains at the Water and Power Resources Service HIPLEX (High Plains Cooperative Program) field sites in Montana, Kansas, and Texas. Nine types of mesoscale organization visible in geosynchronous satellite imagery are illustrated: mountain orographic cumulus, convergence lines (lines of convective clouds), vorticity sheet (line of intense lateral shear), cloud street of cumulus, jetstream, cirrus bands, mesohigh associated with thunderstorms, cloud clusters, differential heating due to low stratus and fog, and upslope stratiform conditions. The cloud categories used are: clear, small cumulus (very small, wide spread, haze like), small cumulus (distinct cells), cumulus congestus, cumulonimbus, stratocumulus, stratus, altocumulus, altocumulus castellatus, and cirrus. Methods used to identify these categories are described to aid user interpretation of information available on visible satellite imagery. Three examples of synoptic characteristics inferred by cloud patterns are also illustrated and discussed. (Seigler-IPA)
W80-05111

STOCHASTIC ANALYSIS OF ANNUAL RAINFALL AFFECTED BY URBANIZATION,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 2B.
W80-05119

BED LOAD: DEFINITION AND MEASUREMENT,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
P. J. Murphy, and M. I. Amin.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 759-766, 1978. 7 Fig, 3 Ref. NSF ENG76-17263.

Descriptors: *Bed load, *Model studies, *Bed load samplers, Sediments, Movement, Particle size, Hydraulic models, Sampling, Bottom sampling, Sediment transport, On-site tests, Analytical techniques, Analysis.

The purpose of this paper was twofold: (1) to explain the difference between bed load and suspended load, and (2) to report the development of a compartmented pit sampler. A particle is defined to be in a turbulent suspension during the time it is carried beyond the bounce limit by the supportive turbulent velocity fluctuations. The rest of the time it moves as bed load. A depiction of this definition was given schematically. The compartmented trap is composed of a watertight box, its sliding cover, and a large number of removable compartments. During a test the compartments are filled with the sediment that moves along the bottom of the streambed. Since the compartments in the downstream end of the trap can catch only those particles that have jumped over the containers in the upstream end of the trap, the downstream compartments catch a smaller mass of moving sediment than do the upstream ones. This variation in the deposition of the sediment permited the calculation of the fraction of the total sediment sample with a particular jump length. (See also W80-05159) (Humphreys-ISWS)
W80-05231

7C. Evaluation, Processing and Publication

SMOOTHED DATA AND GRADIENTS USING SLIDING POLYNOMIALS WITH OPTIONAL CONTROLS,
Science and Education Administration, Athens, GA. Southeast Watershed Research Program.
W. M. Snyder.
Water Resources Bulletin, Vol 16, No 1, p 22-30, February 1980. 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Data processing, *Analytical techniques, *Analysis, Computer programs, Regression analysis, Climatic data, Weather data, Hydrologic data, Sliding polynomials, Smoothed data, Data smoothing.

Sliding polynomials differ from other piecewise interpolation and smoothing methods in their functional continuity at the nodes. This functional continuity was used to establish optional spacing of nodes and optional boundary controls in data smoothing while still maintaining mathematically continuous rates or gradients. Cyclic as well as noncyclic data can be smoothed. Variance of the individual nodal values, derived through least-squares optimization, can be calculated using the rigorously determined weighting coefficients between data points and nodes. Such nodal variances are estimates of localized uncertainty in the data which complement the localization of smoothing through use of piecewise functions. Choice of controls in smoothing and calculation of variance were incorporated in a computer program for user convenience. (Sims-ISWS)
W80-05140

THE EFFECT OF DATA INDEPENDENCE IN MODEL CALIBRATION AND MODEL TESTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
M. L. Shrader, R. H. McCuen, and W. J. Rawls.
Water Resources Bulletin, Vol 16, No 1, p 49-55, February 1980. 13 Tab, 6 Ref.

Descriptors: *Model studies, *Mathematical models, *Calibrations, *Hydrology, Rainfall, Runoff, Rainfall-runoff relationships, Hydrographs, Unit hydrogrphas, Regression analysis, Analytical techniques, Hydrologic data, Peak discharge, Data processing, Equations.

With the increased use of models in hydrologic design, there is an immediate need for a comprehensive comparison of hydrologic models, especially those intended for use at ungaged locations (i.e., where measured data are either not available or inadequate for model calibration). But some past comparisons of hydrologic models have used the same data base for both calibration and testing of the different models or implied that the results of model calibration are indicative of the accuracy at ungaged locations. This practice was examined using both the regression equation approach to peak discharge estimation and a unit hydrograph model that was intended for use in urban areas. The results suggested that the lack of data independence in the calibration and testing of regression equations may lead to both biased results and misleading statements about prediction accuracy. Additionally, although split-sample testing is recognized as desirable, the split-samples should be selected using a systematic-random samplin scheme, father than random sampling, because random sampling with small samples may lead to a testing sample that is not representative of the population. A systematic-random sampling technique should lead to more valid conclusions about model reliability. For models like a unit hydrograph model, which are more complex and for which calibration is a more involved process, data independence is not as critical because the data fitting error variation is not as dominant as the error variation due to the calibration process and the inability of the model structure to conform with data variability. (Sims-ISWS)
W80-05141

DESCHUTES RIVER BASIN SUSPENDED SEDIMENT TRANSPORT STUDY,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 2J.
W80-05153

PERTURBATION SOLUTIONS FOR WATER-TABLE AQUIFERS,
Geological Survey, Tacoma, WA.
For primary bibliographic entry see Field 2F.
W80-05158

A GRAPHICAL COMPUTATION SYSTEM FOR THREE-DIMENSIONAL LAKE CIRCULATION AND CONTAMINANT DISPERSION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
J. A. Liggett, R. H. Gallagher, J. Salmon, and G. Blandford.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 529-540, 1978. 6 Fig, 5 Ref, 1 Append. NSF ENG76-05029.

Descriptors: *Lakes, *Water circulation, *Path of pollutants, *Computer programs, Graphical meth-

ods, Equipment, Computers, Data processing, Mathematical models, Model studies, Finite element analysis, Analytical techniques, *Computer graphics, Graphical output, Display systems, Graphical input, Graphical computation.

As computer programs become larger, the major expense of calculation is often not the computer time but is the data preparation and interpretation of the output. A major liability of computer usage is the precise manner in which data must be supplied (cards or magnetic tape which generally are punched by hand in the first instance). The results usually appear as printed numbers, although computer-driven plotters have become common. Computer graphics alleviates these shortcomings by allowing the user to communicate with the computer--in both the input and output phases--in a quasi-analogue, operator-oriented fashion which seems more natural to the user. The computer itself takes on the primary function of data preparation, and it presents the results in a manner that can be interpreted easily and quickly. This paper described a graphics system which acts as a pre- and post-processor for the computation of three-dimensional circulation in homogeneous lakes. The convection and diffusion of a contaminant were included, which can lead immediately to an elementary pollution analysis. The full graphics capability was presented on a video tape which leads the viewer through the input, analysis, and results of an example. A description of the graphics system hardware was presented in the appendix. (See also W80-05159) (Sims-ISWS)
W80-05205

SEDIMENT TRANSPORT IN MIGRATING BED FORMS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2J.
W80-05207

CURRENT COMPUTER PRACTICES WITHIN CIVIL ENGINEERING,
Maryland Univ., College Park. Dept. of Civil Engineering.
D. R. Schelling.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 791-799, 1978. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Computers, *Civil engineering, *Computer programs, Programming languages, Management, Soils, Hydraulics, Bridges, Documentation, Reviews, Structures, Computer practices, Computer uses, Software.

The current status of computer utilization within the civil engineering field was examined. Specific information pertaining to existing engineering computer programs, program sources and needs, computer hardware, language, documentation standards and practices were presented in condensed tabular form. The use of the computer within the practice of civil engineering is widespread and extremely diverse. The proliferation of computer programs and the associated duplication of effort is at least partially due to the incompatibilities between computer systems and the multilanguage environment. Coupled with this, the lack of adequate documentation on existing software effectively negates the usefulness of many existing programs. (See also W80-05159) (Humphreys-ISWS)
W80-05235

ON THE SCALING OF LABORATORY OXYGENATION STUDIES,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Wasserbau III.
For primary bibliographic entry see Field 5G.
W80-05236

MAPPING MODEL FOR DETERMINING LAND SUITABLE FOR IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Industrial and Management Systems Engineering.
R. O. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-188683, Price codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Final Report, April 28, 1980. 23 p, 3 Fig, 2 Tab, 7 Ref. OWRT A-039-NEB(1).

Descriptors: *Mapping, *Irrigable land, *Land classification, *Computer models, *Nebraska, Land use, Maps, Remote sensing, Soil types, Data processing, Aerial photography, Administration, Mathematical models, Algorithms.

CMS II, a computer composite mapping system, was adapted for use on the IBM 360, Model 198 computer system at the University of Nebraska for use in developing a Nebraska map showing land that is suitable for the development of irrigation systems. The CMS-II program is written in COBOL and the memory core requires 256 K bytes. CMS-II can be used to collate many forms of maps, taped data, and tabular data; grid size can be set as fine as the basic data will allow. The CMS-II program was tested using data from Dundy County located on the western edge of Nebraska. A land use mapping process was used based on viewing each piece of land on two separate color IR aerial photos, one taken in early summer and the other in late summer. Separate computer plots were produced for each of 27 types of land use. The program was also used to develop a mathematical model that predicts the number of acres that will be developed in future years for each soil series. Advantages of the CMS system are its ability to handle both quantitative and qualitative data and its inclusion of a factor weighing algorithm. CMS-II was found to be easy to use with high potential as a tool for analyzing the effects of water allocation and management. (Seigler-IPA)
W80-05246

PHYTOPLANKTON-ZOOPLANKTON ASSOCIATIONS IN LAKE SUPERIOR: A STATISTICAL APPROACH,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W80-05268

WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1978.
Geological Survey, Charleston, WV. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153307, Price Codes: Microfiche only, MF/A01. Geological Survey Water-Data Report WV-78-1, November 1979. 357 p, 4 Fig.

Descriptors: *West Virginia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 118 gaging stations, stage only records for 3 gaging stations, stage and contents for 7 lakes and reservoirs, contents for 1 reservoir, change in contents for 1 reservoir, water quality for 47 gaging stations, and water levels for 31 observation wells. Also included are 3 crest-stage partial-record stations, and 4 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (Kosco-USGS)
W80-05288

WATER RESOURCES DATA FOR ARIZONA, WATER YEAR 1978.
Geological Survey, Tucson, AZ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133556, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AZ-78-1, November 1979. 604 p, 8 Fig.

Descriptors: *Arizona, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. This report contains discharge records for 241 gaging stations, annual peaks for 77 crest-stage partial-record stations, and discharge measurements at 58 miscellaneous sites; contents only records for 9 lakes and reservoirs; stage and contents for 1 lake; elevations only for 2 lakes or reservoirs; gage height only for 1 lake and 1 head over a dam; 16 supplementary records, included with gaging-station records, consisting of monthend or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; 2 low-flow investigations; water-quality records for 87 continuous-record stations and 16 miscellaneous sites; water levels for 101 observation wells; and water-quality data for water from 189 wells. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal and State agencies in Arizona. (Kosco-USGS)
W80-05289

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1978.
Geological Survey, Helena, MT. Water Resources Div.
Geological Survey Water-Data Report MT-78-1, December 1979. 824 p, 11 Fig, 6 Tab.

Descriptors: *Montana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resource data for the 1978 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 211 gaging stations, stage only records for 1 lake station, stage and contents for 9 lakes and reservoirs, water quality for 129 stations and 3 lakes, and water levels for 23 observation wells. Also included are 173 crest-stage partial-record stations and 52 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (Kosco-USGS)
W80-05290

8. ENGINEERING WORKS

8A. Structures

COMPOUND WEIR DISCHARGE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W80-05194

VERIFICATION OF PROTOTYPE SPILLWAY PERFORMANCE,

Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W80-05195

AN EXPERIMENTAL INVESTIGATION OF UPLIFT PRESSURES,
Bechtel Incorp., San Francisco, CA.
A. Prakash, C. Arumugam, and A. Jagadheesan.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 396-406, 1978. 4 Fig, 1 Tab, 6 Ref, 1 Append.

Descriptors: *Hydraulic structures, *Dams, *Uplift pressure, *Model studies, Laboratory tests, Analog models, Groundwater, Groundwater movement, Pressure, Filters, Soil filters, Wells, Structures.

Impervious floors of hydraulic structures founded on pervious soils are subjected to uplift pressures caused by the seepage of water beneath the structure floor from the upstream to the downstream side. Groundwater movement under the foundations of structures with large width-to-lenght ratios is often treated as two-dimensional. But, for structures with smaller width-to-length ratios, groundwater movement in the lateral direction from or to the underside of the structure to or from the ambient water table significantly affects the distribution of uplift pressure, and the resulting flow pattern is three-dimensional. To simulate three-dimensional seepage below hydraulic structures, an electrical analog was developed, calibrated, and verified with field-measured values. The analog was used to predict three-dimensional seepage pressures on the floors of structures with (1) end and side sheet piles, and (2) intermediate filters and relief wells. It was assumed that groundwater movement was within the Darcy range; Dupuit-Forchheimer approximations held, and steady state conditions prevailed. (See also W80-05159) (Sims-ISWS)
W80-05196

SURFACE FLOW IN A TWO-BAY WATER DIVERSION,
Los Angeles County Flood Control District, CA.
T. L. Tanner, and Y. C. Kim.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 407-414, 1978. 4 Fig, 4 Ref.

Descriptors: *Diversion structures, *Flow, *Canals, *Model studies, Mathematical models, Hydraulic models, Intakes structures, Diversion dams, Clogging, Diversion, Hydraulics.

Surface flow patterns in a water diversion structure were synthesized by a hydraulic model and a mathematical model. The flow patterns for a steady state flow were evaluated to determine the influence of three operational schemes on an intake clogging problem caused by floating debris. The hydraulic model was a distorted scale model of the diversion structure. The mathematical model was a three-dimensional application of a finite difference relaxation method. The models indicated that by operating the diversion structure with the water-inflated dam nearest the diversion canal lower than the other dam, the problem would be minimized. (See also W80-05159) (Sims-ISWS)
W80-05197

ROMAN WELLS,
Hilleary and Associates, Catonsville, MD.
J. Hilleary.
Water Well Journal, Vol 34, No 5, p 71-72, May, 1980. 1 Fig.

Descriptors: *Water wells, *Dug wells, *Shallow wells, Construction, Well casing, Water pollution, Ground water, England, History.

Hand-dug wells in England were constructed by Roman laborers in shallow, unconsolidated aquifers. A 3x3 foot square of oak planks functioned as supports and frames for side panels. Water seeped in through the sides and bottom of the well. Upon completion of the well, the pit was backfilled and a housing built over it. Water was lifted by means of a rope attached to a wooden bucket. When the wells were abandoned, they became trash collectors and contaminated newer wells dug nearby. Another style of Roman well construction was the stone and wooden well in which the stone was inserted on the bottom half of the well and oak planking installed on the upper half. Barrel casings were sometimes used as long as the barrel staves did not collapse and the well depth was less than 4 feet. Although many barrel-cased wells have been clogged for centuries the oak staves are in remarkable condition. A willow basket casing made of twigs of willow woven into a strong and coherent fabric was also used for shallow wells. (Purdin-NWWA)
W80-05245

8B. Hydraulics

MINIMUM REYNOLDS NUMBERS FOR PHYSICAL MODEL SIMILARITY,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
A. F. Babb, J. Amorocho, and C. Lomax.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 61-69, 1978. 6 Fig, 4 Ref.

Descriptors: *Hydraulic similitude, *Hydraulic structures, *Reynolds number, *Hydraulic models, Model studies, Flow characteristics, Open channel flow, Surge tanks, Orifices, Siphons, Outlet works, Flow system, Free surfaces, Froude numbers, Energy loss, Gates, Conveyance structures.

This paper discussed several model investigations where minimum Reynolds numbers have been identified. The geometries tested were varied and involved flow systems of both the free surface and closed types. Included are studies of open channel warped transitions for the California Aqueduct, surge tank orifices for the Helms Pumped Storage Project in California, and siphon outlet structures also designed for use with pumping plants in the California Aqueduct. Results of tests presented give minimum Reynolds numbers for physical model similarity for some shapes not generally available in the literature. The tested shapes consisted of a warped open channel transition, a surge tank orifice, and a pump discharge line siphon outlet structure. In general, the model scales selected for the studies were large enough to permit model tests to be conducted at Reynolds numbers exceeding the minimum value for acceptable model-prototype similarity. The study on the warped transitions illustrated the importance of simulating approach conditions in the determination of energy loss coefficients. (See also W80-05159) (Humphreys-ISWS)
W80-05164

A HYBRID COMPUTER SYSTEM FOR GROUNDWATER MODELING,
South Florida Water Management District, West Palm Beach.
For primary bibliographic entry see Field 2F.
W80-05175

PHYSICAL MODEL STUDY FOR IMPROVED NAVIGATION CHANNEL DESIGN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
H. O. Turner, Jr.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 265-272, 1978. 6 Fig, 5 Ref, 1 Append.

Descriptors: *Navigation, *Channels, *Ships, *Model studies, Hydraulic models, Laboratory tests, Design, Reynolds number, Waves(Water), Canals, Navigable waters, Analytical techniques, Research facilities, Hydraulic similitude, Navigation channels.

The U.S. Army Engineer Waterways Experiment Station is currently conducting a study to determine the minimum dimensions of deep-draft navigation channels. These minimum dimensions will include the various safety aspects so as to provide for safe and efficient navigation. This research study is being conducted with free running remote-controlled scale models of prototype ships. The objective of the model study is focused on the improvement of navigation channel design methods and not necessarily a study of ship maneuverability improvements. The model ships will be used as a means of evaluating the channels being tested. (See also W80-05159) (Sims-ISWS)
W80-05182

MATHEMATICAL MODELS FOR NAVIGATION CHANNEL DESIGN,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. J. Huval.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 273-279, 1978. 4 Fig, 11 Ref.

Descriptors: *Navigation, *Channels, *Ships, *Model studies, Mathematical models, Canals, Navigable waters, Design, Analytical techniques, Simulation analysis, Navigation channels.

The U.S. Army Engineer Waterways Experiment Station has recently undertaken an investigation to determine the minimum dimensions of deep-draft navigation channels compatible with the assurance of safe operating conditions. The study will provide the necessary information to improve existing channel design criteria. The research effort was initially designed to employ only a physical scale model with several types of free-running model ships navigating a variety of possible channel configurations. However, during the early phases of the project, it was thought desirable to undertake a review of potentially useful mathematical models and ship simulators. This paper summarized the study of the applicability of ship simulators, physical models, and mathematical model techniques for use in the study of navigation channel improvements and design. Neither of the three analysis methods alone can provide all the required information to design a navigation channel. Each of the three research techniques has unique capabilities and deficiencies. The three research methodologies should be used jointly in a complementary fashion. (See also W80-05159) (Sims-ISWS)
W80-05183

RADIAL SOURCE-SINK FLOW IN STRATIFIED OCEAN,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
G. H. Jirka, and R. P. Johnson.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 311-316, 1978. 4 Fig, 4 Ref.

Descriptors: *Flow, *Water circulation, *Model studies, Mathematical models, Energy, Oceans, Stratification, Density stratification, Thermal stratification, Hydraulics, Ocean thermal energy conversion.

Ocean thermal energy conversion (OTEC) is a method of generating power using the vertical temperature gradient of the tropical ocean as an energy source. The upper layer of the ocean collects heat energy by absorbing solar radiation. The underlying water is colder due to the return flow from polar regions which occurs within the global circulation of the world ocean. Thus a temperature-stratified system is formed. The vertical salinity distribution is usually locality dependent. However, its effect on density is generally much weaker than that of temperature. In total, a stable density

stratified system is formed consisting of a thin upper layer (in the order of 100 m (300 ft)) and a deep lower layer separated by a thermocline-pycnocline with strong gradients of temperature and density. Various OTEC design options and associated problems of research and development have been described elsewhere. One of the critical problems from a hydrodynamic standpoint is the potential for recirculation. Recirculation is defined as the repeated intake of diluted water which has passed through the evaporator or condenser. Recirculation would have detrimental effects on plant efficiency due to a further reduction of the available temperature difference and possible adverse environmental impact due to the local accumulation of chemicals used in plant operation. This paper presented a schematic approach to the problem which is believed to yield realistic first-order estimates of the recirculation potential for purposes of plant design evaluation. The analytical approach was verified with laboratory experimental data. (See also W80-05159) (Sims-ISWS)
W80-05186

VORTEX FORMATION IN A POWERPLANT COLLECTION BASIN,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
Y-H. Wang, G. Powell, and J. B. Miller, Jr.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 335-342, 1978. 4 Fig, 2 Tab.

Descriptors: *Vortices, *Structures, *Discharge(Water), *Model studies, Hydraulic models, Pipes, Flow, Air entrainment, Water levels, Basins, Heated water, Powerplants, Hydraulics, Discharge structures.

During the design of a basin to collect hot water from three units of a southeastern utility's central power station, concern arose as to whether a vortex would form at the entrance to the discharge pipe from the basin. The collection basin and discharge pipe are being constructed in order to relocate the plant's thermal discharge from its current location in a tidal estuary to a large river approximately 3000 feet away. The maximum flow rate through the 196 inch pipe would be 569,000 gpm. This question of a vortex formation is difficult to answer due to the complicated dynamics and boundary conditions. Since this problem was not amenable to purely analytical techniques, a hydraulic model was deemed most appropriate. The objectives of the model study were to determine qualitatively: (1) whether there would be a vortex formation at the entrance to the discharge pipe capable of entraining air into the pipeline, and (2) if so, what measures could be taken to alleviate such a problem. (See also W80-05159) (Sims-ISWS)
W80-05188

COMPOUND WEIR DISCHARGE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
F. W. Blaisdell, and C. L. Anderson.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 381-388, 1978. 4 Fig, 1 Ref, 2 Append.

Descriptors: *Weirs, *Discharge(Water), *Channels, *Model studies, Mathematical models, Design, Structures, Hydraulic structures, Flow, Orifices, Orifice flow, Erosion, Hydraulics, Compound weirs.

A weir, U-shaped in plan and compound-trapezoidal-shaped in elevation, was sized to fit a head-discharge relationship predetermined by site requirements. An imposed site limitation was a constructed channel in a wide flood plain. The initial design was a box inlet weir, U-shaped in plan and trapezoidal in elevation. The bank-full capacity of this spillway exceeded the channel capacity. This caused the approach channel water surface to drop down upstream of the spillway. To prevent overbank flow from dropping into the approach channel and eroding the banks in the vicinity of the drop structure, the drop spillway capacity at bank-full head had to be decreased to equal the bank-full channel capacity. This was accomplished by a low level weir U-shaped in plan and trapezoidal in elevation of less capacity than the original weir. To limit the head rise for floods exceeding the channel capacity, a lengthened crest was required. This was accomplished by superimposing on the low level weir a long high level weir with its crest at the flood plain level. The high level weir was also U-shaped in plan and trapezoidal in elevation. The final weir proportions met the imposed requirements. The head-discharge relationship for the compound weir was mathematically modeled by developing (straightening out or linearizing) the U-shaped crest, separating the developed crest into elements, and analyzing the elements as rectangular and triangular weirs and a triangular orifice. The analysis was verified and the discharge coefficients were evaluated by a physical model. (See also W80-05159) (Sims-ISWS)
W80-05194

VERIFICATION OF PROTOTYPE SPILLWAY PERFORMANCE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
C. L. Anderson, and F. W. Blaisdell.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 389-395, 1978. 7 Fig, 1 Ref.

Descriptors: *Spillways, *Hydraulic structures, *Model studies, Hydraulic models, Flow, Discharge(Water), Structures, Laboratory tests, Hydraulics, Drop spillways, Inlet structures.

Flow phenomena which could not be explained occurred in the principal spillway of the Marsh Creek Dam of the Marsh-Kellogg Watershed Project in Contra Costa County, California. Analyses of hydrologic data recorded in January 1967 revealed differing head-discharge relationships for rising and falling stages of the outflow. Also, during the falling stage of a January 1969 runoff, significant flow was observed through the spillway even though the reservoir level was below the spillway crest level. Engineers inspecting the spillway in June 1972 had differing explanations for the spillway performance and the effect of the air vents in the drop inlet. To resolve the differences expressed by experienced engineers and to explain the unusual performance of the prototype, a model study was conducted in 1973. The prototype and its performance and the model and its reproduction of the prototype performance were described and illustrated. (See also W80-05159) (Sims-ISWS)
W80-05195

SURFACE FLOW IN A TWO-BAY WATER DIVERSION,
Los Angeles County Flood Control District, CA.
For primary bibliographic entry see Field 8A.
W80-05197

ANALYSIS OF SUB- AND SUPERCRITICAL DAM-BREAK FLOWS,
Michigan State Univ., East Lansing. Dept. of Civil Engineering.
D. C. Wiggert, and C. S. Martin.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 680-689, 1978. 5 Fig, 13 Ref.

Descriptors: *Dam failure, *Waves(Water), *Theoretical analysis, *Mathematical models, Flow, Model studies, Flood waves, Bores, Analysis, Floods, Methodology, Numerical analysis, Analytical techniques, Subcritical flow, Supercritical flow, Dam break, Method of characteristics.

Following a review of the analytical solution, two numerical models were adapted to model the idealized sudden dam break flow. The method of characteristics and the implicit scheme employ a fixed grid in the time-distance plane and are known to possess the ability to transmit discontinuities, or bores, of weak to moderate strength. In addition, the method of characteristics can facilitate subcritical or supercritical flows. Based on the criterion of bore height and discharge at the dam, the implicit scheme and the method of characteristics were shown to approximate the idealized dam break solution in which initial flow in the system may exist. Whereas the implicit scheme is valid only for subcritical flows, the method of characteristics can be applied to a mixed flow regime. (See also W80-05159) (Humphreys-ISWS)
W80-05223

VERIFICATION OF TRANSIENT MIXED-FLOW MODEL,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
C. C. S. Song.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 690-701, 1978. 6 Fig, 8 Ref.

Descriptors: *Mathematical models, *Mixing, *Flow, Model studies, Calibrations, Open channel flow, Closed conduit flow, Analytical techniques, Mathematics, Analysis, Hydraulic models, Mixed flow.

In order to optimize the use of existing or new combined sewer systems for pollution abatement, it may be necessary to make use of the in-line storage capacity as well as their capacity to convey water and sewage. Flow in such a system would undergo the change of flow regimes in a typical sequential manner, open channel-mixed-closed conduit-mixed-open channel, at a large storm event. A mathematical model capable of dealing with the unsteady variable regime flows is necessary to help design such a system. This paper explained some features and the calibration process of a model constructed for the Pure Water District of Monroe County, New York. It was demonstrated by comparing a physical model with a mathematical model that the transient flows with phase change can be satisfactorily modeled mathematically. The major problem in the mathematical model is the jump condition associated with the moving interface. (See also W80-05159) (Humphreys-ISWS)
W80-05224

DEVELOPMENT OF MAKEUP LINE SAFE OPERATING CRITERIA,
Bechtel Inc., Norwalk, CA.
P. K. Su, and I. Joseph.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 702-714, 1978. 8 Fig, 2 Tab, 1 Ref, 1 Append.

Descriptors: *Unsteady flow, *Pipelines, *Flow system, *Model studies, Thermal powerplants, Pressure conduits, On-site tests, Computer models, Pumping, Water delivery, Automatic control, Hydraulics, Flow, Fluctuations, Operations, Simulation analysis, Water levels, Pressure, Makeup water.

A field experiment and mathematical analysis of the hydraulic transients were performed on the makeup lines of the Navajo Generating Station. The makeup line hydraulic transient analysis was performed using Bechtel's hydraulic transient analysis program. This transient analysis was performed to calibrate the computer model in order to reproduce the field data. After adjusting the head loss coefficients of the pipeline and the shock-trap orifice in the mathematical model, the results show a satisfactory agreement between the measured and calculated transient response at the shock-traps and several points along the pipeline. The mathematical model was then used to develop system operating criteria which includes automatic control of the water levels in the shock-trap for various flow rates. The system is protected from adverse tran-

sient effects due to power interruptions. (See also W80-05159) (Humphreys-ISWS)
W80-05225

THE LOYALSOCK CREEK MODEL STUDY,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
A. C. Miller, R. A. Chadderton, and S. A. Brown.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 745-752, 1978. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Hydraulic models, *Bank erosion, *Streams, *Pennsylvania, Model studies, Erosion control, Bank protection, Calibrations, Backwater, Profiles, Slope protection, Floods, *Loyalsock Creek(PA).

A physical model of the Loyalsock Creek meander immediately upstream of Pennsylvania State Highway 220 (Legislative Route 1073, Section C-17) was constructed on a 1 to 90 scale, both in the vertical and horizontal dimensions. The undistorted model was constructed to achieve quantitative velocity and depth measurements for a wide range of flow magnitudes. No attempt was made to model a partially moveable boundary because of the restrictively small model scales involved. The study has progressed with testing and analysis of the undistorted, fixed bed model, Phase I. Model data and analyses presented indicate a substantial potential for further erosion of the east bank of Loyalsock Creek as the meander continues to grow. Flood flows will also create potential to erode the existing rock protection that has placed along the south bank of the Mill Creek realignment channel and the lower east bank of Loyalsock Creek. Phase I testing did not indicate any eminent danger of the highway embankment being breached from any one particular storm; however, long-term effects were not studied and will be included in the second phase of the research. (See also W80-05159) (Humphreys-ISWS)
W80-05229

SEDIMENT MODEL VERIFICATION FOR SMALL DIVERSIONS,
Water and Power Resources Service, Denver, CO.
For primary bibliographic entry see Field 2J.
W80-05230

ON THE SCALING OF LABORATORY OXYGENATION STUDIES,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Wasserbau III.
For primary bibliographic entry see Field 5G.
W80-05236

UNIFIED PRESENTATION OF BUOYANT SURFACE JETS IN THREE DIMENSIONS,
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.
R. E. Baddour, and V. H. Chu.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 811-818, 1978. 6 Fig, 8 Ref.

Descriptors: *Jets, *Buoyancy, *Flow characteristics, *Model studies, Laboratory tests, Flow, Analysis, Analytical techniques, Turbulent flow, Spatial distribution, Saline water, Heated water, Freshwater, *Surface jets, Buoyant jets, Wall jets, Two phase flow.

The paper discussed a buoyant wall jet in three dimensions. The wall jet was simulated in the laboratory by injecting saline water along a flat bottom in a tank of fresh water of lighter density. Basic properties related to the development of three-dimensional buoyant shear layers in general were discussed from the results of the wall jet experiment. These properties were used to interpret results of heated surface jets. The results presented are the first part of a larger investigation and perhaps raise more questions than can be answered. Future investigation should pay more attention to the temperature distribution in the region outside the turbulent core. The rather unusual buoyancy distribution presented has suggested a region of relatively high temperature which may occur on the two sides of the jet. (See also W80-05159) (Humphreys-ISWS)
W80-05237

BIFURCATION OF BUOYANT JETS IN A CROSSFLOW,
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.
M. S. Abdelwahed, and V. H. Chu.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering; Proceedings of the 26th Annual Hydraulics Division Specialty Conference, Maryland University, College Park, August 9-11, 1978, p 819-826, 1978. 10 Fig, 3 Ref.

Descriptors: *Jets, *Flow characteristics, *Model studies, Laboratory tests, Open channel flow, Analysis, Analytical techniques, Data collections, Spatial distribution, *Buoyant jets, Crossflow, Bifurcation, Two phase flow.

Bifurcated jets were simulated in the laboratory by discharging hot or cold water into an open channel crossflow through an orifice located at the channel bottom. The jet was observed first to bend over and form a pair of vortex-like turbulent elements. As the jet impinged on the free surface, it bifurcated into two separated regions; between them a clear space extended continuously. Due to restriction by the width of the crossflow channel, it has not been possible to investigate quantitatively the spreading behavior of the bifurcated jet in the far field region. But based on some qualitative observations at very low crossflow velocity, the pair of bifurcated vortex was observed in the far field region to break down into two rolls of counterrotating vortex street. The breakdown is apparently the result of suppression of vertical motion due to gravity stratification. In the course of rotating the vortex vector toward the vertical direction the vortex pair breaks down into vortex street. It is difficult to know whether entrainment would stop in a vortex street. The entrainment coefficient obtained in the present experiment was found to depend rather weakly on the Richardson number. This might be an indication that entrainment does not vanish but approaches a constant in the far field region. Further experimentation in a wider channel is obviously needed to settle this question. (See also W80-05159) (Humphreys-ISWS)
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